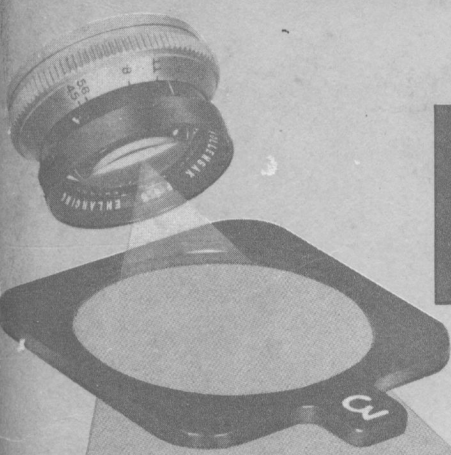


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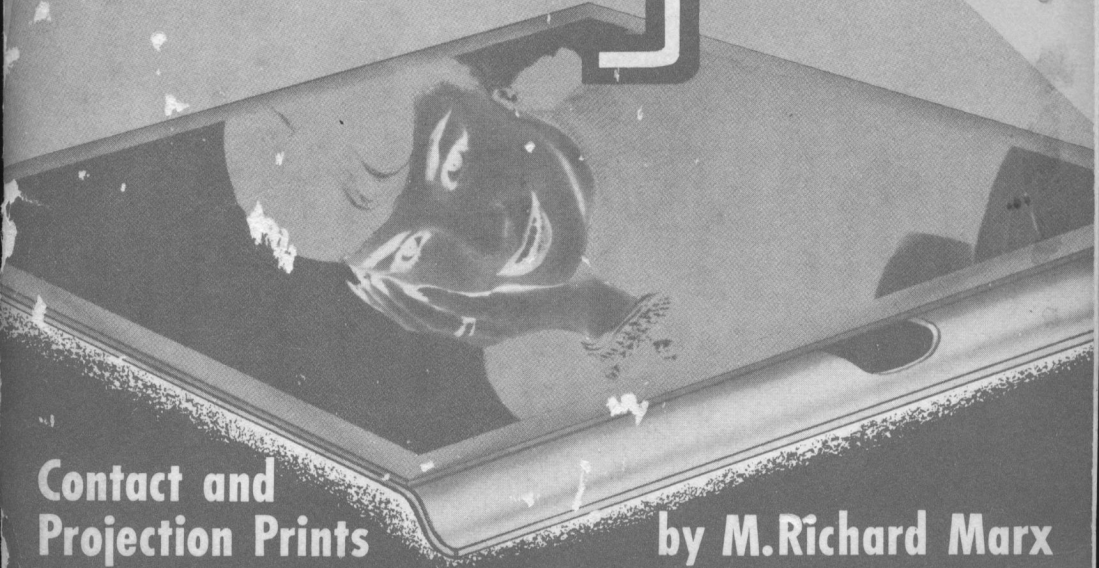
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PRINTING

WITH

00 **Varigam** 00



Contact and
Projection Prints

by M. Richard Marx

ACKNOWLEDGEMENTS

Sincere thanks are extended to E. I. Du Pont De Nemours & Co., for supplying detailed information on their variable contrast papers and for checking this manuscript for factual accuracy.

Valuable help was also obtained from Aristo Grid Products, Inc., Campus Camera Shop, Simmon Bros., Urban Engineering and Yankee Photo Products, who supplied photographs of their equipment and much useful information.

A special note of appreciation is due Mr. R. Seward Hagaman, co-inventor of "Varigam", who is now an active research consultant of The Haloid Co., for details on the "Varaloid" papers and much illuminating background information.

This modest little volume is privileged to carry a foreword by Dr. Rowland S. Potter, the co-inventor of "Varigam", and the author is grateful for his generous cooperation.

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THE EVOLUTION OF "VARIGAM"

By Rowland S. Potter, F.P.S.A., F.R.P.S.
Co-Inventor of "Varigam"

If good prints are to be obtained, it is absolutely necessary for the gradation of the printing paper to fit or complement the gradation of the negative. Since any photographer who deals with a variety of subjects is bound to come up with negatives of different gradation and length of scale, photographers have long sought for a precise means of adjusting the gradation of the paper to the gradation of the negative.

In the early days the photographer had to be content with just one grade of contrast (steepness of gradation) in the paper he used for printing from his negatives. Later, it became known that the papers made by various manufacturers differed considerably one from another in steepness of gradation. It then became common practice for good photographers to stock the paper of several manufacturers so that best results could be obtained from different negatives. The products, unfortunately, differed in speed and tone as well as in steepness of gradation. Resort was also had to over and under exposure with short or prolonged development in an effort to obtain gradation control, but this was usually accompanied by loss of quality.

Developers allegedly giving soft and hard gradation were also used but this procedure, being very inconvenient to carry out, did not satisfy the critical user.

Then the manufacturers made their papers in two, three, or more grades of contrast (steepness of gradation), but still, the available papers did not always have the gradation needed and the photographer was compelled to keep even larger stocks of paper on hand.

Forty years ago a German, Rudolph Fischer, proposed to obtain gradation control in one paper by mixing hard and soft emulsions together. One of the two emulsions was made sensitive to green light and control of gradation was obtained by altering the color of the light used for printing. There is no need to go into the difficulties encountered, it is sufficient to say that the product did not reach a serious market.

1942 03 22 603
Ray Haganaw

The ultimate character of a photographic product is the summation of the sensitivity characteristics of the individual silver halide (bromide, bromo-chloride or chloride) grains, the essential ingredient in the emulsion coating of photographic paper (there are many millions of such grains per square inch of paper surface). Each grain requires a definite and unique exposure to light to become developable to black silver. Now, if these grains do not differ greatly in sensitivity to light, we have a paper of high contrast or steep gradation—if, however, the individual grains differ widely in light sensitivity, we have a paper of soft gradation. These silver halide grains are normally sensitive only to blue light but can be made sensitive to other colors by appropriate treatment with certain types of dye. If the grains of an emulsion are sensitized to green light we obtain a product which will have essentially similar gradation to either blue or green light.

If a means can be found which will cause some of the mixed silver halide grains to become more sensitive to color (green) than others, we will extend the sensitivity range to that color light (green) beyond the sensitivity range to blue light; such a product will give soft gradation when exposed to green light (yellow is green plus red) and hard gradation when exposed to blue light.

Such a product was developed by the writer and his assistants in the Research Laboratories of the Defender Photo Supply Co. of Rochester (since acquired by DuPont) of which he was then in charge. A suitable set of light filters was also developed so that any desired gradation could be obtained by printing through one or the other of these filters without practical change in exposure, the full density from black to white being always obtainable.

We have now progressed a long way towards simplicity in gradation control. No longer is it necessary to stock a variety of paper grades, nor to monkey with many trays of developer.

It is hoped that the reader will pardon this brief diatribe on the evolution of "Varigam" variable contrast photographic paper, and that it may be interesting to most of the photographers who appreciate the simplicity in use and special effects obtainable with "Varigam" paper, so well described in this booklet by Richard Marx.

INTRODUCTION

This book explains how "Varigam" and other variable contrast papers differ from graded printing papers, tells how they work, and describes the best techniques for making every sort of print from the simplest to the most complex.

The author firmly believes that the flexibility of variable contrast papers makes straightforward printing easier to learn, makes complex printing operations easier to carry out, and that the unique qualities of this type of paper provide the answer to many printing problems otherwise impossible of solution from a practical point of view.

Since the second edition of this book appeared in March 1955, Du Pont has introduced a new variable contrast paper under the name of "Varilour" and has also licensed three other manufacturers to produce variable contrast papers.

Since this book covers all variable contrast papers which are generally available, it would be logical to change the title to "Printing with Variable Contrast Papers". This has not been done because we feel that a large proportion of photographers are not familiar with this term, whereas they do know what is meant by "Varigam". So, throughout this book, if you chance to be using "Varilour" or one of Haloid's "Varaloid" papers, simply read the name of the paper you are using in place of the name "Varigam". Whenever reference is to "Varigam", or one of the other papers, exclusively, the fact will be made abundantly clear.

For a complete list of variable contrast papers see page 94, Chapter 12.

It is the author's hope that this book will prove to be a clear and certain guide to fine print quality, for each and every reader.

M. RICHARD MARX
Los Angeles, California

1. ADVANTAGES AND DISADVANTAGES OF "VARIGAM"

Three Kinds of Contrast

To produce rich luminous prints which depict the character of the subject with maximum effectiveness the photographer must achieve a proper balance between three different kinds of contrast. Contrast in the subject, contrast in the negative and the contrast of the printing paper.

It is essential for the photographer to have a clear understanding of each type of contrast, so let us begin by examining each in detail, in terms of the conventional types of printing papers, that is, papers other than "Varigam."

This procedure will provide the background information needed to clearly understand how "Varigam" differs from conventional papers and it will also point out the numerous advantages of convenience, economy and precise control of quality which "Varigam" offers.

Subject Contrast

Virtually all photographers take pictures of a wide variety of subjects. In so doing they inevitably encounter a similarly wide variety of subject contrast. "Contrast" is the popular word for what is more correctly called the *brightness range* of the subject. A subject with high contrast will have a long brightness range. This means that the *difference* in brightness between the brightest part of the subject and the darkest part of the subject is very great. A subject with low contrast, sometimes called a "flat" subject, has a short brightness range. This means that the *difference* between the brightest and darkest parts of the subject is comparatively slight.

The brightness range of a given subject is determined by the interplay of three factors:

1. Intensity of the illumination.
2. Direction of the illumination.
3. Nature of the subject.

Intense illumination alone will not produce a long brightness range. Imagine that you are looking at a beach with the sun coming from directly behind you. The subject is very bright but it has a short

brightness range because there is nothing dark in the scene. If you now turn so that the sun comes from the side you are able to see the shadows cast by objects in the scene and the brightness range is greatly increased. If there are dark rocks in the scene along with the bright sand and water, the brightness range will be increased still more and this points to the influence of the third factor mentioned above. If this same scene is viewed on a cloudy day the brightness range is greatly reduced. The intensity of the illumination is much less and it has lost its directional quality. On an overcast day the light comes from all parts of the sky so there are no shadows.

Negative Contrast

Contrast in a negative is indicated by the *difference* between the most translucent and most opaque parts of the negative. The correct technical term is the *density scale* of the negative. An overexposed negative may be very dense in all its parts and still not be of high contrast. On the other hand an underexposed negative may be fairly thin (translucent) in all its parts and still be of rather high contrast. It is the degree of *difference* between the light and dark parts of the negative that indicates contrast.

The contrast in a negative is determined for the most part by the brightness range of the subject, the exposure, and the amount of development which the negative receives. The skillful photographer is able to exert a considerable amount of control over the contrast of his negatives, but such techniques are outside the scope of this book.

The one fact which is pertinent to our discussion is that all photographers produce negatives of varying contrast, so the skillful printer must know how to produce the best possible print from every kind of negative.

Paper Contrast With Papers Other Than "Varigam"

Contrast in conventional printing papers is perhaps most easily understood in terms of what happens to papers of different grades of contrast when they receive given amounts of exposure. The correct technical term for paper contrast is the *exposure scale* of the paper. Suppose we take two pieces of a high contrast paper and two pieces of a soft (low contrast) paper. We give one piece of each type an exposure of 1 unit, and the other piece of each type an exposure of 3

units, and then develop them. A "unit" of exposure in this case is simply an amount of exposure sufficient to produce a perceptible tone on the low contrast paper without a negative in the enlarger. The piece of high contrast paper which received 1 unit of exposure will be almost devoid of tone, but the piece which received 3 units of exposure will be black or virtually so. The low contrast paper which received 1 unit of exposure will show a definite tone and the piece which received 3 units will show a somewhat darker tone but will not be nearly so dark as the piece of high contrast paper which received 3 units of exposure.

Thus we see that a high contrast paper is highly sensitive to small differences of exposure, while a low contrast paper requires much greater differences of exposure to produce a noticeable difference in tone on the paper.

Let us now see how these facts apply when we print from negatives of high and low contrast.

The dark and light parts of a high contrast negative show very great differences in density. Consequently, when such a negative is printed on a low contrast paper, the great differences in transmitted light produce definite differences in tone upon the exposed paper, and a clear and detailed image is produced. On the other hand, if a high contrast negative is printed on a high contrast paper, the paper's great response to small differences of exposure will cause all those parts of the image which were dark in the subject to go entirely black in the print, before the light parts of the image have received enough exposure to appear in the print at all.

A soft, low contrast negative can only produce small differences of exposure because there is little difference between the light and dark parts of such a negative. If we print such a negative on a high contrast paper, the great sensitivity of such a paper to small differences of exposure will cause it to record each small variation of exposure as a separate tone in the print and thus produce a clear and detailed image.

If we print a low contrast negative on a low contrast paper the small differences in light striking various areas of the paper will not be sufficient to produce separate tones in the print, and a dull gray print will result.

This brings us to the first principle of correct printing: *The con-*

trast of the paper must balance the contrast of the negative. In other words:

A high contrast negative must be printed on a low contrast paper.

A normal negative must be printed on a normal paper.

A low contrast negative must be printed on a high contrast paper.

The best quality print can be achieved only when this balance is precisely adjusted. Keep this fact in mind, for one of the most important advantages of "Varigam" is the opportunity it affords for a more accurate adjustment of this balance than is possible with any other printing medium.

Printing Papers Other Than "Varigam"

In order to make it possible for the photographer to achieve satisfactory prints from negatives of varying contrast, most papers are offered in several grades of contrast.

Contact papers are usually offered in 6 grades of contrast, projection papers in from 1 to 4 or 5 grades of contrast, depending on the purpose for which they are intended. Papers intended primarily for portrait studios which produce negatives of quite uniform contrast are usually offered in only 1 or 2 grades of contrast, while papers intended for amateur or general use are offered in from 3 to 5 grades of contrast.

Physical Characteristics

All printing papers including "Varigam" have four physical characteristics other than grade of contrast. These are generally called *Tint, Weight, Surface* and *Texture*

Tint refers to the color of the paper upon which the emulsion is coated—white, cream white, or buff.

Weight refers to the thickness of the paper, usually identified as either single weight for the thinner papers or double weight for the thicker ones. A few papers are offered in a medium weight.

Surface refers to the reflective characteristic of the surface, and is described by a variety of terms such as matte, for a non-shiny surface, to semi-matte, lustre, and glossy for progressively more reflective surfaces.

Texture refers to the texture of the paper surface and is also described by a variety of terms which differ considerably from one manufacturer to another.

It is not uncommon for a general purpose paper to be available in a dozen or more combinations of tint, weight, surface and texture. For example, Du Pont "Velour Black," one of the most popular general purpose enlarging papers, is offered in 12 combinations of tint, weight, surface and texture and in 4 grades of contrast. Not all of the 12 combinations are available in all 4 contrast grades but there are actually 39 different "Velour Black" papers manufactured.

The First Advantage of "Varigam"

Obviously no photographer will have need of such a bewildering variety of papers, but almost all will want some variety in paper characteristics. Some subjects appear to best advantage on a glossy surface, others on a matte or semi-matte surface. A cream or buff stock is often needed when a warm tone is desired.

Let us assume then that you are able to boil down your requirements to 3 combinations of physical characteristics in a paper with 4 grades of contrast. This means that you need to have *12 boxes of paper on hand at all times.*

With "Varigam" you could have this same variety of physical characteristics on hand with only 3 boxes of paper. And with those 3 boxes of paper you would have *10* grades of contrast available instead of *4*, as we shall see in a moment.

So the first major advantage of "Varigam" is *economy*. Fewer varieties of paper need to be purchased, and consequently there are no infrequently used papers which will become out-dated and spoiled.

Balancing the Contrast of the Paper With the Contrast of the Negative

To do this well the photographer must first learn to "read" his negatives accurately so that he can tell what grade of paper will fit the negative. This procedure is discussed in detail in Chapter 4.

With conventional papers the photographer must select the contrast, from the 3, 4, or at most 5 grades which are available. He can increase the contrast of a given paper *very slightly* by adjusting the developer and by decreasing exposure and prolonging development.



tive more accurately.

Other Advantages

There are several other advantages which will become more understandable when some of the more advanced printing techniques have been explained. For example, it is quite practicable with "Varigam" to give an overall exposure with a filter giving one grade of contrast and then change to a filter giving another grade of contrast and "burn-in" a part of the image either to bring out or subdue detail in that area. Such advantages will be made clear as the various techniques are described. See chapters 9 and 10.

Disadvantages of "Varigam"

First, of course, is the fact that the filters for "Varigam" are needed and this represents an initial outlay for equipment which is not necessary with other printing papers. The cost is small, however, and it will be more than offset over a period of time by the savings made because fewer packages of paper have to be kept on hand.

Some feel that it is annoying to have to place the filter in front of the enlarger lens before making each print. It can certainly be so if the worker has not devised a firm and convenient filter holder. If the filter holder is permanently and solidly attached in the manner described in Chapter 3, however, such annoyance disappears.

The experienced worker will have settled upon a few papers and a printing routine with which he is presumably satisfied. The question which confronts him is whether the effort and practice required to make the change would be worthwhile. This is clearly a question which each individual must decide for himself. All we can suggest is that a reading of this book will provide the essential information upon which an informed decision should be based.

Many photographers who have never tried "Varigam," along with some who have, will be quick to offer the opinion that "Varigam" is difficult to tone.

It is true that the Du Pont Company does not offer a prepared single solution toner, and that "Varigam" does not react satisfactorily in hypo-alum or selenium type toners.

"Varigam" does tone well, however, in any of the several formulas given in Chapter Eleven, so what this objection boils

down to is the complaint that it is less convenient to tone "Varigam" because it does not respond well to some of the more popular single solution toners.

This situation has been completely changed, however, with the introduction of DuPont "Varilour". This paper produces a pleasing warm tone by direct development and tones beautifully in all of the popular single solution prepared toners.

It should be pointed out that the advent of "Varilour" brings the advantages of variable contrast printing to those photographers who are interested in making fine prints for salons or exhibitions. These workers, as a group, have not used "Varigam" very much in the past because of the extra effort involved in toning it. "Varilour" completely overcomes that difficulty. Such workers are vitally interested in the precise control of local tone values within the print. They will find that variable contrast printing offers an opportunity for such control that is more precise and more convenient than any other method available to them.

It is obvious that each photographer must of necessity experiment with whatever paper he elects to use in order to discover a toner which will produce exactly what he wants. Each paper reacts in a more or less individual manner to each type of toner. Nobody knows precisely what color will please a particular photographer, so in every case the problem of toning must be ultimately decided by the worker himself.

The toning formulas given in this book will produce, on "Varigam," "Varilour" or "Variloid", virtually every color which can be obtained on other papers. Finding the tone you want involves trying the various formulas until you discover the one which meets your needs. You would have to do precisely the same with any other paper which was new to you.

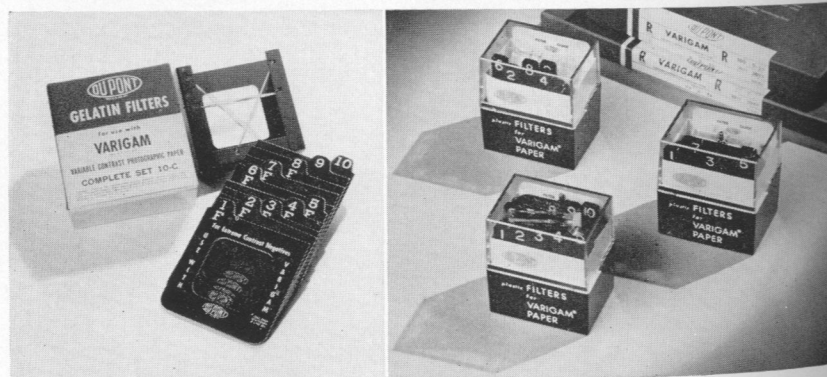
2. EQUIPMENT

As we have already learned, a single sheet of "Varigam" paper can be made to produce 10 different degrees of contrast by the simple method of printing with one or the other of the 10 filters for "Varigam" over the enlarger lens.

The Filters

When "Varigam" was first introduced in 1940 only two filters were available. One was yellow for low contrast; the other blue for high contrast. If a contrast somewhere between the two extremes was desired, it was necessary to make a portion of the exposure through one filter and the remainder of the exposure through the other. Balancing the two exposures was a difficult procedure and certainly called for more skill and patience than most darkroom workers possessed.

The first complete set of filters produced by the Du Pont Company consisted of 10 card-mounted gelatin foils, ranging in color from yellow to blue with the intermediate colors offering evenly spaced steps of contrast. The filters were numbered from #1 (soft) to #10 (hard), and were offered in three different kits. Filter set 5A contained the basic filters #1, #3, #5, #7, and #10 and Filter Set 5B, the intermediate filters, #2, #4, #6, #8, and #9. Filter Set 10C contained all 10 of the filters. By using the entire range of filters



11 The Gelatin Filter Kits, now discontinued.



12 The new Plastic Filter Kits.



13 Plastic Filters and Filter Holder.

in these sets it became much easier to control contrast than by mixing a proportionate amount of color from each of two filters as at first was necessary. By this advance the Du Pont Company had brought the use of this printing medium within the reach of even the most unskilled darkroom worker. The gelatin filters were lacquered to protect them as much as possible from scratches and fingermarks but had to be handled with extreme care to avoid damage. They were packaged in a strong cardboard box with instructions and a filter holder made of metal, which fastened to the lens of any standard enlarger. The size of the filter was $3\frac{1}{2}$ inches square except where the small numbered tab protruded (Fig. 11).

The manufacture of gelatin filters for "Varigam" has now been discontinued.

In 1953, the Du Pont Company introduced new all-plastic filter sets, attractively packaged in a colorful plastic box which also serves very conveniently as a permanent storage box for the filters in the darkroom. These newer filters are ruggedly made of an optical-grade plastic which will neither buckle nor warp and will withstand intermittent heat up to 250° F., or continuous heat up to 140° F. The new plastic filters will resist most fumes encountered in photographic darkrooms, are not easily scratched, and can be readily cleaned with mild soap and water. The new filters are packaged in sets 5A, 5B and 10C just as the gelatin filters were (Fig. 12). Each set includes, in addition to the plastic box, a plastic filter holder which fits over the lens barrel of any standard enlarging lens by simply screwing in the

threads of the three lock screws attached to the holder (Fig. 13).

The plastic filters measure $2\frac{1}{2}$ inches square with rounded corners not including the numbered tab which also functions as a convenient "handle."

There is also a small bottle of anti-static solution to minimize dust collecting static charges and a small card comparing filter numbers to the contrasts of conventional photographic papers.

Only one drop of the solution, rubbed on each side of the filter is needed to minimize static and dust attracting characteristics of plastic optical filters. The protective coating will last until the filters are washed.

A three ounce bottle of the anti-static solution is also available for those who have need of larger quantities. This large bottle provides an adequate supply of the solution for users of unmounted, sheet-size plastic filters for "Varigam" employed, for example, in contact printing.

Recommended Filters

The above described filters, and filter holder, actually constitute all of the special equipment which the average worker will need, to produce projection prints on "Varigam." The 5A set is recommended for beginners and it provides as much or more control of contrast as is available with any group of conventional printing papers. If, after some experience the worker finds a need for more precise adjustments of contrast, he can then purchase the 5B set and he then has the complete set of filters.

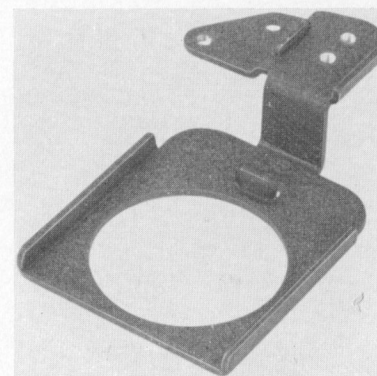
Other Filter Sets

Harrison & Harrison offer a set of 10 glass filters, with the color in the cementing material, the contrast characteristics of which are substantially the same as the Du Pont filters.

The Charles Beseler Co., offer a set of 10 plastic filters made from the DuPont material. These are slightly smaller in size than the DuPont filters so they will fit into the drawer which is provided for them on the Beseler enlarger.

A Warning About Focus

Because of the refractive action of both plastic and glass filters, it is advisable, for critical work, to focus with the filter, or a clear piece



14
Simmons Bros. Filter Holder for Omega Enlargers.

of plastic or glass, in place. If this is not done, there may be a slight displacement of the image when two or more filters are used, one after the other, on a single print after the technique explained in Chapter 9.

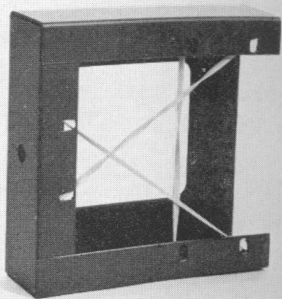
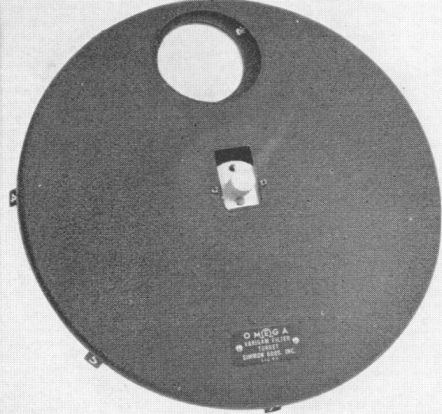
Filter Adapter for "Varigam"

Since filters are fundamental in the use of "Varigam" and the majority of them are used between the lens and the printing easel, it is imperative that a convenient method of holding the filter in position be adopted. This should provide a means of holding the filter parallel to the lens and baseboard of the enlarger and make it possible to change the filter quickly and easily.

Simmon Brothers, Inc., manufacturers of Omega enlargers, make a metal filter holder for all of their enlargers which fastens to the post which carries the red filter (Fig. 14). In addition, for the Omega D-II enlarger, they have developed a filter turret. This is composed of a disk having a diameter of approximately 9 inches, along the inner circumference of which are seven cutouts, and over each cutout one of the seven most important filters is placed so that the entire unit may be mounted on the enlarger and any one of the seven filters brought between the lens and the image for projection (Fig. 15).

The manufacturers of the Elwood Enlargers make a similar turret holder which fits their 4" x 5" or larger machines.

The Du Pont Company used to supply a metal frame with the set of gelatin filters (Fig. 16) providing an inadequate method of hanging the holder from the lens barrel with rubber bands. These criss-crossing rubber bands were not strong enough to suspend such a piece of metal from the lens and inevitably when readjusting the dia-



The Enlarger

"Varigam" can be used with any enlarger, either condenser or diffusion type, which employs the conventional incandescent (tungsten) light sources. Typical enlarger lamps are the General Electric #211, #212 and #302. Similar lamps are produced by Westinghouse, Sylvania and other manufacturers.

Safelamp

Because "Varigam" is sensitive to yellow-green light it cannot be handled safely in the bright yellow darkroom illumination normally used with conventional papers. The Du Pont S-55X safelight has been designed especially for use with "Varigam" and is equally efficient as a safelight for general use with other papers. It is of an orange-brown color which affords an excellent light for judging print quality. When the prints are viewed under this light they appear to have the same contrast as when viewed under white light. The S-55X safelight is supplied in the following sizes to fit most standard darkroom lamps: 2-9/16" and 5 1/2" circles, and in rectangles 3 1/4" x 4 3/4", 5" x 7", 8" x 10", and 10" x 12". In the event no darkroom lamp is available or the proper safelight filter cannot be obtained it is safe to use a ruby electric bulb or a bright red safelight.

Yankee Safelight

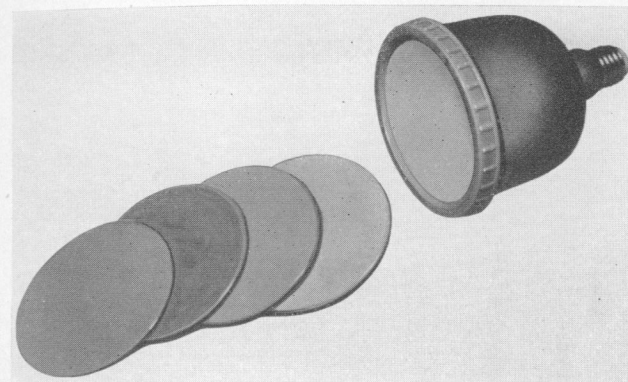
Wherever the S-55X safelight is recommended for variable contrast papers the Yankee Safelight with the brown "V" filter in place may be used. (Fig. 21.)

The safelight is a complete unit with a heat resistant Bakelite housing and a set of 4 filters 4 1/2" in diameter which may be easily interchanged. It is an inexpensive unit which may be screwed into and hung from any standard electric light socket.

The other filters supplied with the unit are a red, for use with orthochromatic film, an orange for use with graded contact and enlarging papers and a green for use with panchromatic film. The recommended working distance with this safelight is 4 feet.

Test Your Safelight

It is very important to make a careful test to be sure that your safelight is entirely safe. A safelight that is too bright or too close



21
Yankee
Safelight.

to the work, will cast a gray veil over all your prints and make it quite impossible for you to obtain fine print quality.

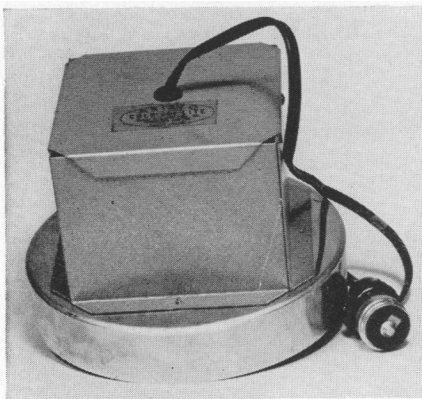
With the safelight turned on place a piece of "Varigam" face up in the position normally occupied by your developing tray. Place a large coin or other entirely opaque object on the paper so that a part of it is completely protected from the light. Leave the paper in this position for from 5 to 8 minutes. Develop it. If there is evidence of tone anywhere, if you can distinguish the covered part from the uncovered part, install a lamp of lower wattage or move the safelight farther away and repeat the test.

It is also desirable to check your safelight for the effect on exposed unprocessed paper. Make an 8" x 10" print from one of your good negatives. Lay it emulsion side up beneath the safelight with one half covered by opaque cardboard for 5 minutes and then develop it. If there is any detectable difference between the covered and uncovered halves of the print the safelight is not safe. The effect in such case will be to reduce the contrast in the uncovered half of the print.

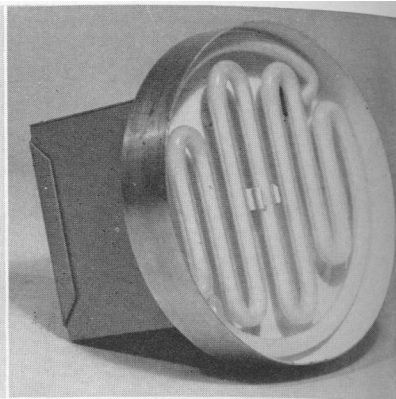
A similar test should be made of the red filter which is placed or swung in front of the enlarging lens to protect the paper from exposure while it is being placed in position on the easel. In normal operations the paper will not be exposed to this light for more than a brief interval, consequently an exposure time of 2 or 3 minutes for this test should provide a sufficient margin of safety.

"Cold Light"

Some so-called "cold" light sources are not suitable for use with



22 The Vari-Lamp.



23 The grid of the Vari-Lamp.

"Varigam" because such sources produce too much red light and not enough green light. Contrast control with "Varigam" depends upon its different response to green and blue light. If insufficient green light is emitted by the source the filter cannot transmit green light to the paper, so contrast control is upset.

However, if a cold light could be produced which would emit the needed proportions of green and blue light it would be entirely satisfactory for use with "Varigam." Such a light was announced by Aristo Grid Lamp Products, Inc. in 1951 and called the Vari-Lamp.

The Vari-Lamp

This unit is available at moderate prices to fit almost every enlarger on the photographic market and can be installed by the user in a matter of a few minutes. The Vari-Lamp produces a blue-green light which is completely absorbed by the emulsion of "Varigam" paper and since other enlarging papers are primarily sensitive to blue light it may be used just as efficiently with them (Figs. 22-23).

In actual use, however (on the Omega D-II enlarger), there are a few disadvantages in using the Vari-Lamp which should be considered. Because a red filter completely absorbs the blue-green light emitted by the Vari-Lamp it is impossible to see the projected image with the red protective filter in place. Consequently, the easel must permit positioning of the sensitive paper when the image is not



24 Condenser enlarger and #5 filter.



25 Vari-Lamp and #7 filter.

visible, if a red protective filter is used. However, the negative image will be visible if the red filter is replaced with the S-55X filter, recommended by DuPont for use in safelights, when working with "Varigam". The printing time with the Vari-Lamp is almost double that with a #212 enlarging lamp and condensers. The contrast is approximately one full filter grade softer with the Vari-Lamp than with the "212" and condensers. There would be much less difference, of course, between a diffusion enlarger and the Vari-Lamp. In use we find that in order to match a print produced with the #212 lamp and condensers through a #5 "Varigam" filter, it would be necessary to use a #7 filter with Vari-Lamp (Figs. 24 and 25).

With the increased use of variable contrast paper, the Charles Beseler Company, have provided their enlarger with the Vari-Lamp but in their trade advertising use the name Beslite.

The Beseler enlarger features a small drawer just above the lens into which the filters for "Varigam" may be inserted. Since the drawer is a little too small to receive the conventional DuPont filters they also offer a complete set of plastic filters made of the DuPont material, in a size that will fit the drawer.

They expect to add a filter wheel which will hold all ten filters, to their line of accessories in the near future. This will fit under the lens.

The Beseler enlarger equipped with the Beslite comes in both the 4 x 5 and the 5 x 7 size and of course, will take any negative of smaller size when used with the appropriate negative carrier and focal length lens.

Other things being equal, first quality prints can be produced with any of the enlarger lighting systems which are suitable for "Varigam." There is no reason to change unless you are experiencing some difficulty which the Vari-Lamp will correct.

The Vari-Lamp should not be confused with the Grad-a-con, which is described below. With the Vari-Lamp you must use the filters for "Varigam" to obtain contrast control in the same way as with ordinary incandescent sources.

Advanced Equipment

Below, for the sake of completeness, we describe various more elaborate items of equipment. Most of these are intended primarily for professional use.

Variable Light Sources

We have already seen that "Varigam" is made so that it produces low contrast prints when exposed to yellow light and high contrast prints when exposed to blue light. Intermediate contrasts are produced by a mixture of the two colors, ranging from yellow-green to blue-green. The filters which we have been discussing produce a change in the contrast of the paper from one filter to another, because the filters change the color of the exposing light.

Obviously if we had a light source the color of which could be adjusted to produce the same colors as those transmitted by the 10 filters, we could then dispense with the filters and use the variable light source directly to produce prints of different contrast on the single grade of "Varigam" paper.

The Grad-a-con

With this in mind Aristo Grid Lamp Products, Inc. developed a unit known as "Grad-a-con." Grad-a-con was perfected through

26

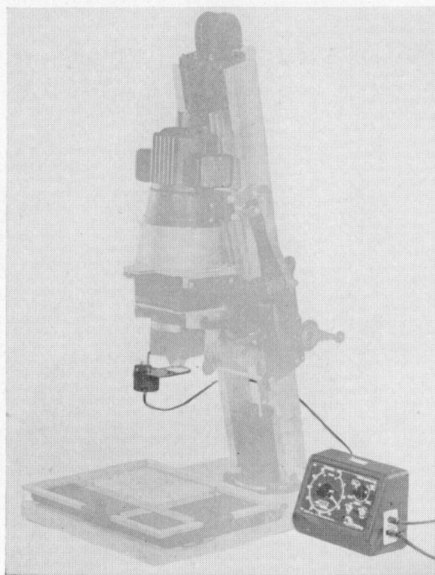
Grad-a-con light source in Omega enlarger. Turn of dial immediately above operator's left hand changes color of light source to approximate same effects achieved by filters with "Varigam" variable contrast photographic paper.



the close collaboration of Rowland S. Potter, who was responsible for the perfection of "Varigam" in 1940, and Andrew Azan, the pioneer of cold light for enlarging. Potter conceived the basic idea of a mechanical device for mixing the light from two light sources matching "Varigam's" response, while Azan contributed the special lamp design and details that made the Grad-a-con possible (Fig. 26).

The Grad-a-con is described as a "cold-cathode" light, the color of which can be changed, by turning a dial, from green to blue and back again or to any combination of blue and green the user's negative requires.* By turning this simple calibrated dial (Fig. 26), numbered from 1 to 10, on the side of the Grad-a-con housing, it is a simple matter to produce any desired degree of contrast. The only major inconvenience that the Grad-a-con imposes upon the user is that the red filter, usually used to protect the paper while it is being put in place, cannot be used since the blue and the green light are

*The reader may be puzzled by the fact that we have indicated the range of colors in the filters as running from yellow to blue, whereas the range of colors in the Grad-a-con is from green to blue. The actual color response of "Varigam" is to green and blue, and the apparent inconsistency disappears when the reader realizes that yellow is green plus red. The red light passed by the lower numbered filters plays no part because the paper is not sensitive to red.



27
Simmon Omega Electronic Variable Contrast Timer.

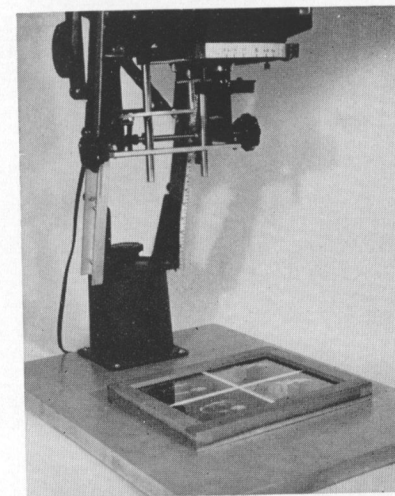
both completely absorbed by a red filter. It is therefore necessary to focus on a piece of non-sensitive paper, and then put the "Varigam" in place on the easel for the exposure, or to use the S-55X filter in place of the red filter.

Comparatively new in the photographic field, this unit has not as yet been widely accepted. Its practicability has been shown, so, for you, the matter boils down to a question of cost versus convenience.

Simmon Omega Electronic Variable Contrast Timer

The introduction of the Simmon Omega Electronic Variable Contrast Timer (Fig. 27) combines the practicability of an electronic timer with an ingenious method of timing through the two basic filters, yellow for low contrast and blue for high contrast. By removing the red focusing filter on any of the Omega enlargers and replacing it with the filter unit of the timer the enlarger is ready for use. It is possible to adapt this timer for use with any enlarger so long as it can be positioned to align the filter unit under the lens.

The timer unit is provided with two dials, independent of each other, one for selecting the grade of contrast desired and the other



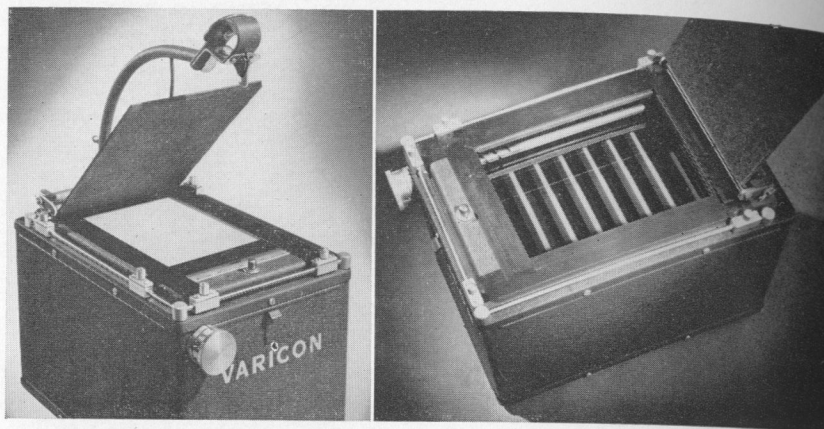
28
The simplest set up for contact printing.

for selecting exposure time. When properly set, a button or foot switch is pressed and the machine will automatically provide the necessary time through each of the two filters for the desired contrast.

This unit completely eliminates the handling of filters and guarantees uniform exposure times for all contrast grades. It is simple to use and may be turned on or off by a switch on the control panel. A switch for focusing is also provided.

Equipment for Contact Printing

The simplest arrangement for making contact prints with "Varigam"—and the method requiring the least expenditure for equipment—uses the enlarger as a light source, the regular filters ordinarily used for enlarging, and a contact printing frame. The negative is placed in the frame emulsion (dull) side up. The paper is placed over the negative emulsion side down so that negative and paper are emulsion side to emulsion side. The printing frame is closed, turned over and placed on the enlarger easel. The filter needed to produce the desired contrast is placed in position below the enlarger lens, the enlarger light turned on and the exposure made (Fig. 28). The use of a large printing frame permits the printing of several negatives of similar contrast at the same time, if proof quality prints are all that are desired.



29 The Varicon contact printer.

29a The Varicon contact printer with printing surface removed to reveal striated filter.

It is best to use the slowest variable contrast paper available, for contact printing, for this will help the worker to avoid exposure times which are too short. At this writing the slowest paper generally available is regular "Varigam."

Filters for "Varigam" in Sheet Form

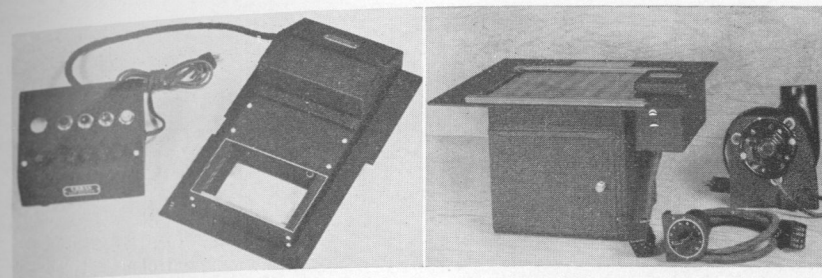
Unmounted plastic filters in sheet form are available in sizes up to 48" x 48". Such filters may be placed on the glass printing surface of any standard contact printer using an incandescent light source, negative and paper arranged emulsion side to emulsion side are placed over the appropriate filter and the exposure is made.

This procedure would not be practical with the old gelatin filters for they would quickly become scratched and finger-marked. The new plastic filters, however, can be cleaned with mild soap and water.

If the negatives are of "normal" contrast, that is, ones which will print best on a #2 grade of conventional paper, they may be printed on "Varigam" without any filter. "Varigam" exposed by incandescent light without a filter has a contrast equivalent to a #2 grade of conventional paper.

The Varicon

For those who can accomplish their ends with a 5 x 7 printer,



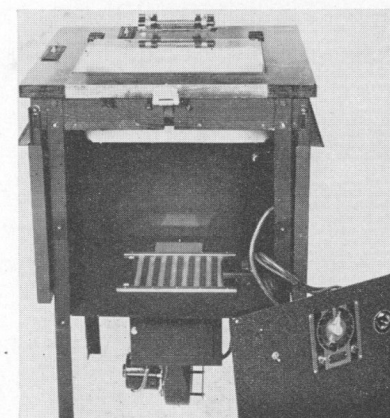
30 Urban "Varigam" Converter Model 2-4.

30a Urban Model 12 Striated Filter Unit.

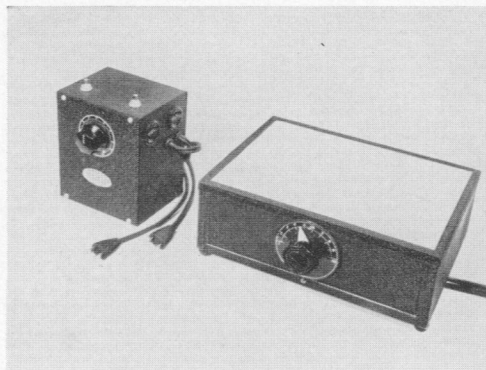
the Campus Camera Shop has developed the Varicon Printer (Fig. 29). This is a medium priced all metal print box incorporating a pair of glass striated filters controlled by a dial (Fig. 29a). When using "Varigam" as a contact paper in any type of contact printer, it is necessary to reduce the light level considerably below that used with normal chloride contact printing papers, since the speed of "Varigam" is greater than that of contact papers. In every other respect, a "Varigam" contact print is exposed and developed out in the usual manner.

Urban Converter Units for "Varigam"

Urban Engineering is now producing three "converter" units which adapt professional contact printers for use with "Varigam." Model 2-4 (Fig. 30) and Model 3 contain four filters, combined with neutral density filters to equalize exposure. They produce contrasts



31 Urban Model 12 Striated Filter Unit installed in Pako printer.



32

The two units of the Aristo Cold Light Contact Printer. The power control unit is seen on the left, the light unit on the right. Contrast control is achieved simply by turning the dial on the front of the light unit.

equal to the #2, #5, #7 and #10 Du Pont filters, and the desired filter is moved into position by pressing one of the buttons seen along the lower part of the control box (Fig. 30). The indicator lights above, show which filter is in position. Model 2-4 is activated by rotary solenoids, and is designed for use in Kodak Rapid Printer models 2 or 4, or in the Pakomatic. Model 3 is manually operated, and is designed for use in the Kodak Rapid Printer, Model 3.

The Model 12 Striated Filter Unit (Fig. 30a) is designed to fit the Kodak Model 12 Professional 11 x 14" Contact Printer. It can be installed in other contact printers with slight modifications to the printer itself. This unit contains a 6½ x 8½" striated upper plate, and a similar size black and white grid plate as the lower cut off plate. By turning the dial seen in the central portion of Figure 30a, the striated filter can be set to deliver any one of 10 degrees of contrast, corresponding to the 10 degrees of contrast obtained with the Du Pont filters. This unit, like Model 2-4, is operated by remote control through the action of a rotary solenoid. The light box contains 4 #212 enlarger lamps and is cooled by a 3½" rotary blower. Figure 31 shows the unit installed in a Pako printer.

The Broun Striated Filters which have been on the market for some time are no longer being manufactured so there is no point in discussing them here.

The Aristo Cold Light Contact Printer

Aristo Grid Lamp Products, Inc., offer a contact printing unit

for variable contrast papers which contains a cold cathode light source and built-in filters so there is no need to handle filters separately. The unit employs the "Vari" lamp which is spectrally balanced for "Varigam" and transmits light which hits the peaks of sensitivity of the "Varigam" emulsion. A filter window and shutter combination is arranged in such a manner that the desired degree of contrast is automatically produced, simply by setting a dial, (Fig. 32, right).

Settings from 1 to 10 are provided which are approximately equivalent to the contrast obtained with the Du Pont set of filters. The dial, however, may be set at any point between numbers, producing an almost unlimited number of contrast steps. The built-in filter plate and light source are so balanced that exposure time, once determined for any given negative, remains the same regardless of the contrast dial setting. The unit contains a built-in red safelight which operates independently of the printing light.

The complete assembly consists of two separate units; the light unit and the power control unit. The light unit is designed to fit into any standard 8 x 10" or 11 x 14" contact printer, replacing the tungsten bulbs with which these printers usually operate. A small potentiometer enables the operator to control the intensity of the printing light if necessary. The unit is easy to install.

3. DEVELOPING AND FIXING SOLUTIONS

"Varigam" variable contrast photographic paper is developed and fixed in exactly the same manner as are conventional papers and no special chemicals are needed to produce prints of top quality. As is the case with any photographic paper, the most suitable formulas to use are those recommended by the manufacturer, since they have already gone to great expense in their own research laboratories to determine the proper combinations for use with their own particular emulsions.

The Du Pont Company offers two developer formulas recommended for use with "Varigam" paper which come in prepared, ready to mix, packaged form, 53-D and 55-D. These are available in vacuum sealed cans, to make stock solutions of 1 quart, 1/2 gallon, 1 gallon, 5 gallons and 25 gallons.

53-D is an all purpose developer for normal tone and contrast. For those who prefer to mix their own solutions the formula follows:

Du Pont 53-D All-Purpose Developer

Stock Solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Metol	45 grains	3.0 grams
Sodium Sulfite, anhydrous	1 1/2 ounces	45.0 grams
Hydroquinone	175 grains	12.0 grams
Sodium Carbonate, monohydrated*	2 oz. 278 gr.	79.0 grams
*If anhydrous, use.....	2 1/4 ounces	67.5 grams
Potassium Bromide	27 grains	1.9 grams
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Dilution and Use:

Dilute one part stock solution with two parts water.

Use at 68° F. (20° C.) and develop "Varigam" for 1 1/2 to 2 1/2 minutes.

55-D is a standard paper developer producing tones of a warmth midway between the 51-D and 53-D formulas.

Du Pont 55-D Standard Paper Developer

Stock Solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Metol	36 grains	2.5 grams
Sodium Sulfite, anhydrous	1 1/4 ounces	37.5 grams
Hydroquinone	146 grains	10.0 grams
Sodium Carbonate, monohydrated*	1 oz. 205 gr.	44.0 grams
*If anhydrous, use.....	1 1/4 ounces	37.5 grams
Potassium Bromide	73 grains	5.0 grams
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Liberal use of Potassium Bromide is permissible—with a range of 5 to 13 grams of bromide per liter of stock solution. When excess bromide is added to the developer, overexposure with one and one-half minute development, or less, will give warmer tones.

Dilution and Use:

Dilute one part stock solution to two parts water.

Develop for one to two minutes at 68° F. (20° C.).

51-D is intended for use in making warm tone prints and portraits. It gives more warmth than is found in the pure black tones obtained by normal or photofinishing formulas. Not available in prepared form.

Du Pont 51-D Warm Tone Paper Developer

Stock Solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Metol	22 grains	1.5 grams
Sodium Sulfite, anhydrous.....	3/4 ounce	22.5 grams
Hydroquinone	90 grains	6.3 grams
Sodium Carbonate monohydrated*	256 grains	17.5 grams
*If anhydrous, use.....	1/2 ounce	15.0 grams
Potassium Bromide	22 grains	1.5 grams
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Dilution and Use:

Use one part stock solution and one part water with normal development time of one and one-half to two minutes at 68° F. (20° C.).

58-D is a chlor-hydroquinone developer, for still warmer tones on "Varigam" paper. Prints developed in this formula, when toned, will give warmer tones throughout the series than 55-D.

Du Pont 58-D Chlor-Hydroquinone Developer

Stock Solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Sodium Sulfite, anhydrous.....	232 grains	16.0 grams
Chlor-Hydroquinone (Adurol)	58 grains	4.0 grams
Sodium Carbonate, monohydrated*.....	275 grains	18.7 grams
*If anhydrous, use.....	232 grains	16.0 grams
Potassium Bromide	7½ grains	0.5 gram
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Dilution and Use:

Use one part stock solution and one part water. It is necessary to develop 4 minutes at 68° F. (20° C.) to obtain the maximum black of the paper, at which time the tone is perceptibly warmer than with 55-D developer. Shorter developing times with increased exposure will sacrifice the maximum black somewhat but warmer tones are obtained. Prints developed in this formula, when toned, will give warmer tones throughout the series than when 55-D developer is used.

The Du Pont recommended stop bath is a standard used with all papers of any manufacturer.

Du Pont 1-S Acid Stop-Bath

	<i>Avoirdupois</i>	<i>Metric</i>
Water	32 ounces	1.0 liter
Acetic Acid, 28%*.....	1½ fl. oz.	48.0 cc.

*To make 28% acetic acid from glacial acetic acid dilute three parts of glacial acetic acid with eight parts of water.

After development rinse prints thoroughly for at least 10 seconds in the stop-bath solution before placing in the fixing bath.

The Du Pont 18-F Universal Fixer is a single powder in prepared package form suitable for all types of papers, films and plates. Easy to mix because of the single powder feature, this formula also contains a mild aromatic agent which counteracts the acid fumes usually associated with acid fixing baths. The 18-F solution will fix 25 sheets of 8 x 10 paper or its equivalent per quart. Exhaustion is not indicated by the appearance of a sludge, but only by a slowing down of the rate of fixation. For best results the fixer solution should be used at 65° to 70° F. (18°-21° C.).

The Du Pont 2-F White Alum Fixing Bath is recommended for those desiring to mix their own fixing bath.

Du Pont 2-F White Alum Fixing Bath

	<i>Avoirdupois</i>	<i>Metric</i>
Water (120° F. or 48° C.).....	26 ounces	850.0 cc.
Sodium Thiosulfate (Hypo).....	8 ounces	240.0 grams
<i>After hypo has been dissolved, add the following hardening solution to the cool hypo solution:</i>		
Water (120° F. or 48° C.).....	2½ ounces	75.0 cc.
Sodium Sulfite, anhydrous.....	½ ounce	15.0 grams
Acetic Acid, 28%.....	1½ fl. oz.	47.0 cc.
Potassium Alum	½ ounce	15.0 grams

Dissolve chemicals in the order given.

The 2-F fixing bath will show a white flocculent precipitate as its exhaustion point is near. When this occurs discard the bath.

The 2-F fixing bath will fix approximately 15, 8 x 10 prints per quart (liter) or their equivalent in other sizes if a water rinse is used; approximately 30, 8 x 10 prints per quart (liter) if the acid rinse bath (Formula 1-S) is used between development and fixation. The temperature of the bath should be kept close to 68° F. (20° C.).

Immerse prints carefully face up to prevent air bells forming on the surface. Keep the prints separated and allow them to fix for at least fifteen minutes in the fresh bath to assure complete fixation.

The Du Pont 8-F fixing bath is particularly recommended for the fixing of prints which are to be toned.

Du Pont 8-F Metabisulfite Fixing Bath

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Sodium Thiosulfate (Hypo).....	8 ounces	240.0 grams
<i>When thoroughly dissolved, add:</i>		
Potassium Metabisulfite	350 grains	24.0 grams
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Fix prints for at least five minutes in the above solution with thorough agitation. Following fixation, wash prints very thoroughly.

While the Du Pont formulas and chemicals are recommended for use with "Varigam," many photographers have become accustomed to certain other formulas or may have a stock on hand in the darkroom. They need not discard these solutions or packages. A test print will quickly show if they are suitable for use with "Varigam." Such standard packaged developers as Eastman Kodak Dektol and Selectol are satisfactory. Dektol produces a print of normal tone and

Du Pont 58-D Chlor-Hydroquinone Developer

Stock Solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water (125° F. or 52° C.).....	24 ounces	750.0 cc.
Sodium Sulfite, anhydrous.....	232 grains	16.0 grams
Chlor-Hydroquinone (Adurol)	58 grains	4.0 grams
Sodium Carbonate, monohydrated*.....	275 grains	18.7 grams
*If anhydrous, use.....	232 grains	16.0 grams
Potassium Bromide	7½ grains	0.5 gram
Add cold water to make.....	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Dilution and Use:

Use one part stock solution and one part water. It is necessary to develop 4 minutes at 68° F. (20° C.) to obtain the maximum black of the paper, at which time the tone is perceptibly warmer than with 55-D developer. Shorter developing times with increased exposure will sacrifice the maximum black somewhat but warmer tones are obtained. Prints developed in this formula, when toned, will give warmer tones throughout the series than when 55-D developer is used.

contrast similar to the Du Pont 53-D formula. Selectol is for use when warmer tones are desirable. Ansco developers, Vividol and Ardol, produce similar results to their Kodak counterparts. Any of the standard paper developers made by FR, Mallinckrodt and others may be satisfactorily used. Edwal Scientific Products Corp. has produced a liquid prepared formula known as Platinum Tone which when diluted 1 part developer to 9 parts water produces prints of equal quality to those processed in the standard Du Pont 53-D formula. It is especially recommended by Edwal for use with "Varigam."

All other standard fixing baths are effective on "Varigam." Kodak Acid Fixer and Ansco Acid Fixer are available in prepared powder form and for those who prefer a concentrated liquid fixing bath there are those made by FR, Edwal and others.

Developer Additives

One other chemical, benzotriazole, is helpful in producing better prints under certain circumstances and is not to be overlooked. It is a developer additive and is very simple to use. There are three varieties under different trade names, but all are similar in use.

The first of these is B-B Photographic Developer Additive produced by Du Pont and available in one ounce bottles. It is intended to produce maximum brilliancy, impart a blue-black tone, reduce paper fog and extend the life of the developer. It is particularly useful in suppressing fog when using out-dated papers, papers that have been improperly stored or when forced development is necessary. It is easily prepared for use by dissolving 150 grains of B-B Additive in 1 quart of water. (If no scale is available about 1/3 of the bottle's contents may be dissolved in 1 quart of water or the contents of the 1 ounce bottle dissolved in 3 quarts of water). For use add 1 to 3 ounces of the prepared solution to each quart of working solution. The exact quantity to use depends upon the tone desired and is best judged by a sample print. It is most satisfactory in 53-D.

The two other available products are Kodak Anti-Fog No. 1 and Edwal Orthazite. Kodak Anti-Fog is available in both tablet and powder form and the Orthazite is available as a liquid. The simple instructions which accompany each item should be followed carefully.

Such solutions are not a cure-all for carelessness or defective prints. They should be looked upon as an aid for use in emergencies.

4. LEARNING TO "READ" THE NEGATIVE

In the opening chapter we discussed the three kinds of contrast with which the photographer must deal. We saw that variations in subject contrast produce variations in negative contrast, and that in order to produce the best possible print from negatives of varying contrast we must be able to adjust the contrast of the printing paper to fit the contrast of the negative.

With conventional papers the adjustment is made by selecting the most suitable contrast grade from among those available in the particular paper being used.

With "Varigam" the adjustment is made by selecting the *filter* which will produce the desired contrast.

So, in order to select the proper filter for any given negative, we must be able to "read" that negative. Is it of low contrast, medium contrast, high contrast or something in between?

Make it a consistent practice to read your negatives by transmitted light, that is, by light which passes through the negative before it reaches your eyes, for it is the light passing and light stopping qualities that you are interested in. Use the same light, and place the negative at the same distance from the light each time, so you will always view the negative under the same conditions. If a contact printing box is available, this is excellent for the purpose.

Figures 33, 36 and 38 show a low contrast negative, medium contrast negative and a high contrast negative in that order. Examine these carefully taking particular notice of the *difference* between the most translucent and the most opaque parts of each.

The low contrast negative (Fig. 33) is gray and dull. Both the shadows and the highlights lack snap or brilliance. A print, obtained by using the #5 filter is just as dull and lifeless as the negative and is clearly unsatisfactory (Fig. 34). However, by using a #10 (high contrast) filter, contrast can be achieved and a usable print results (Fig. 35).

The medium contrast negative (Fig. 36) presents no problems and may be printed through the #5 filter (Fig. 37), or with no filter at all, to produce a normal print. Notice that it has a full range of



33 Low contrast negative. 34 Print from low contrast negative with #5 filter. 35 Print from low contrast negative with #10 filter.

middle tones and that the thin portions or shadow areas as well as the dense portions or highlight areas contain definite detail.

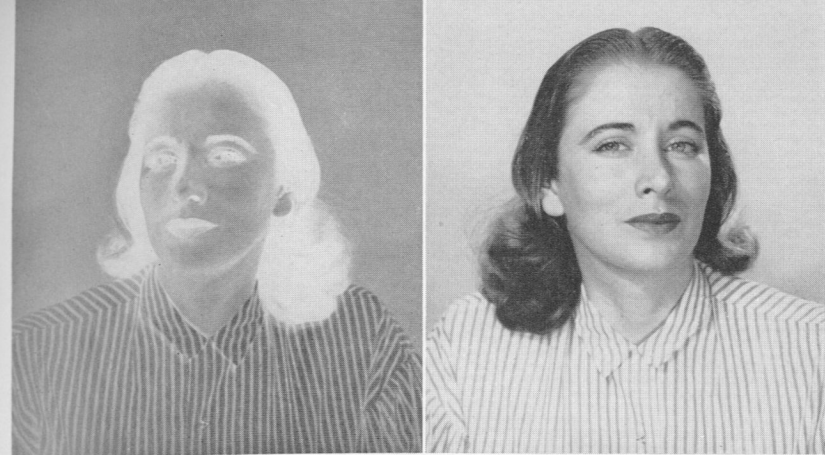
The high contrast negative (Fig. 38) is too transparent in the shadows and slightly blocked up in the highlights. A print with the #5 filter shows little detail in the shadow area and chalky whites in the highlights (Fig. 39). By printing this negative with the #3 filter (Fig. 40) a more desirable print results with no harsh shadows or glaring whites. In other words, the difference between the lightest and darkest portions of the negative have been lessened in the print.

Selecting the Proper Filter

After a little practice the photographer is usually able to make a fairly accurate filter selection simply by examining the negative.

But the beginner and even the experienced worker in the case of difficult negatives, will find that he can save time and paper by making a test strip, or a series of small test prints. The test prints should be large enough to allow for an easy comparison, each should include the same portion of the picture and they should be made at the same degree of enlargement that will be used for the finished picture. A test print comprising one-third of an 8 x 10" sheet is a convenient size.

If there is considerable doubt regarding the most suitable filter make the test with odd-numbered filters such as 1-3-5, 3-5-7 or 5-7-9. If you are fairly sure of the approximate contrast required and only wish to refine your estimate, use consecutively-numbered filters such as 3-4-5, etc. Of course, the difference in result obtained with any two



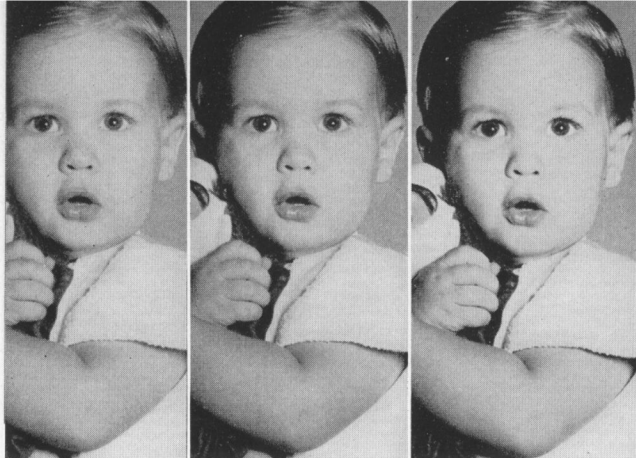
36 Medium contrast negative. 37 Print from medium contrast negative with #5 filter.

consecutively-numbered filters is slight as you can see by examining Figures 1-10, but it is just such subtle variations which make the difference between a fairly good and a truly fine print.

If the tests are to be made on separate pieces of paper, simply make the exposures one after the other through the three selected filters, but develop the three tests together and for exactly the same length of time. Or, the three tests can be made on one sheet of 8 x 10" paper. From a sheet of fairly stiff cardboard cut two pieces measuring 3-5/16 x 8". If these are laid together over an 8 x 10" sheet of paper they will cover two-thirds of the sheet and leave one-third exposed. Make your first test exposure with the protective cardboards so placed. Change to the next filter, place the two cardboards at each end of the

38 High contrast negative. 39 Print from high contrast negative with #5 filter. 40 Print from high contrast negative with #3 filter.





41

Test strip for determining which filter to use. Three exposures on one piece of paper using the #3 filter at left, the #5 filter in center and the #7 filter on the right.

sheet so that the center one-third is uncovered and make the second exposure. Change to the third filter, cover the two exposed portions of the sheet with the cardboards and make the third exposure. Move the paper on the easel after each exposure so that each of the three tests includes about the same portion of the image. When the sheet is developed you have the same picture printed in three grades of contrast on the one sheet of paper—a feat that is possible only with “Varigam” (Fig. 41).

Examine your test, after 30 seconds in the fixing bath, by white light to determine which filter produces the most desirable contrast.

Contrast Comparisons

The reader will be interested to know how great a range of contrast is obtainable with variable contrast papers and how this range compares with that obtainable with graded papers. To clarify these points we have prepared the table on page 45.

The table shows the contrast relationships between the six variable contrast papers and compares these to the contrast grades available in Velour Black and Kodabromide.

Observe that with the #1 filter “Varilour” is one filter grade lower in contrast than high speed “Varigam” and all three of the “Varaloid” papers; two filter grades lower than regular “Varigam”. It is also two filter grades lower in contrast than the softest grade of Kodabromide. Consequently, if you desire an absolute minimum of contrast your choice would be “Varilour”.

At the other end of the scale, regular “Varigam” produces slight-

Contrast Comparison

Graded Papers		Variable Contrast Papers With Plastic Filters					
Kodabromide	Velour Black	Regular “Varigam”	H. S. “Varigam”	“Varilour”	Regular “Varaloid”	H. S. “Varaloid”	Fast “Varaloid” Proof
				1			
			1	2	1	1	1
		1	2	3	2	2	2
	1	2	3	4	3	3	3
		3	4	5	4	4	4
2		4	5	6	5	5	5
	2	5	6	7	6	6	6
3		6	7	8	7	7	7
		7	8	9	8	8	8
	3	8	9	10	9	9	9
4		9	10		10	10	10
	4	10					
5							

ly more contrast than any of the other variable contrast papers when the #10 filter is used. But this contrast is not quite as great as that obtainable with the #5 grade of Kodabromide. Kodabromide is the only projection paper which is made in a #5 grade, so if you are seeking maximum contrast this would be your choice. Maximum contrast with variable contrast papers is obtained with regular "Varigam" and the #10 filter.

The in between steps in the table show the approximate contrast obtained with the various filters compared with the graded papers.

The Du Pont Filter Kit carries a small white card indicating the approximate contrast produced by the various filters compared with the *average* contrast of graded papers. In the more recent kits small gold and black stickers carrying the same figures are provided for pasting onto the filters. These figures are as follows:

Filter No.	1	2	3	4	5	6	7	8	9	10
Conventional Paper Grade	0	1/2	1	1 1/2	2	2 1/2	3	3 1/3	3 2/3	4

The observant reader will notice that this comparison does not completely coincide with the comparison in our table on page 45, but he should not jump to the conclusion that either table is in error. The Du Pont table compares an *average* of all graded papers with the contrast produced by the various filters on regular "Varigam". Our table compares specific papers. Notice that in our table Kodabromide 3 is approximately equal to regular "Varigam" with #6 filter, Velour Black 3 to the #8 filter. An *average* of these would indicate a #7 filter as is shown in the Du Pont table. Both tables are necessarily approximations, intended only as guides, but are sufficiently precise for all practical purposes.

5. HOW TO DETERMINE EXPOSURE FOR "VARIGAM"

Quite obviously the "speed" of the paper you are using is an important factor in determining the amount of exposure required for a given print. Both "Varigam" and "Varaloid" are available in two speeds, designated as regular, for the slower papers, and high speed, for the faster papers.

The speed of "Fast Varaloid Proof" is identical with high speed "Varaloid" and the speed of "Varilour" closely approximates these.

The graph on page 48 reports the results of a *practical* test conducted to indicate the relative speeds of the papers listed. We emphasize the word practical because this data is not presented as being scientifically accurate, it is only intended to serve as a guide. Seven and one half diameter enlargements were made with an Omega D-II, condenser type enlarger, with the lens aperture at F:8, all from the same negative, of course. Prints were made on each of the six variable contrast papers, first without a filter and then through each of the ten filters. Prints were also made under the same conditions on Du Pont Velour Black, a popular medium speed projection paper and on Kodak Kodabromide, a high speed projection paper (without filter, of course) to provide a speed comparison between graded and variable contrast papers.

The exposure times are indicated on the vertical axis and the filters used along the horizontal axis. Thus the graph shows that regular "Varigam" *under the given conditions* required an exposure of 13 seconds without filter, 28 seconds with the #1 to #7 filters, 33 seconds with the #8 to #10 filters. The exposure times required for the other five variable contrast papers can be read off the graph in similar fashion. Notice that all of the variable contrast papers require a slight increase of exposure when the #8, #9 or #10 filters are used.

The graph also shows that *under the given conditions* Velour Black required an exposure of 12 seconds and Kodabromide an exposure of 5 seconds, without filter, of course. This information should be helpful to those who are making the transition from graded papers to variable contrast papers.

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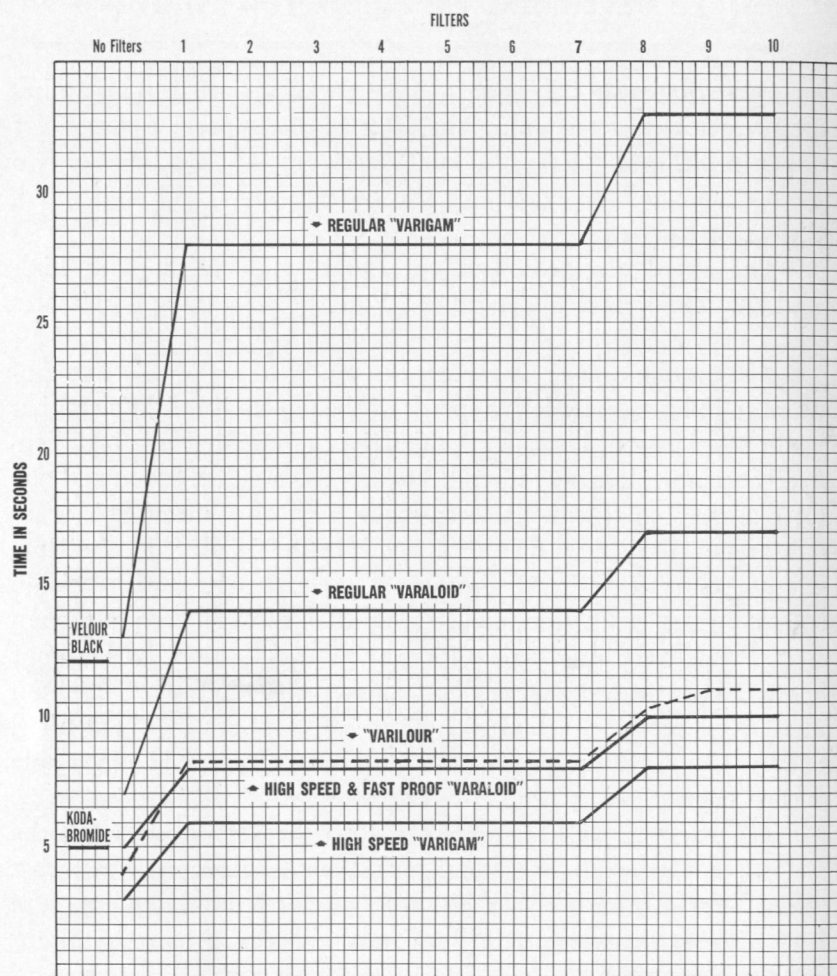
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The graph also shows that *under the given conditions* Velour Black required an exposure of 12 seconds and Kodabromide an exposure of 5 seconds, without filter, of course. This information should be helpful to those who are making the transition from graded papers to variable contrast papers.

SPEED COMPARISON



In the above chart, "Varilour" is shown with a dotted line because the exposures for this paper and for High Speed and Fast Proof "Varaloid" actually coincided at several points.

"Varilour" required one second less exposure than the two "Varaloid" papers, when no filter was used. The exposure for all three papers was identical for the #1 through #8 filters. "Varilour" required one second more exposure than the two "Varaloid" papers with the #9 and #10 filters.

Aside from paper speed there are three factors which determine the amount of exposure required, with given equipment, and with all enlarging papers. These are, the density of the negative, the size of the enlargement and the aperture or f/number at which the enlarging lens is set. Let us examine each of these factors in more detail.

The amount of light passing through the negative is controlled by its density, a thin negative allowing more light to pass than a dense negative and thus requiring less printing time. The brilliance of the light is greatest when a small enlargement is made and the enlarging head is closest to the easel. When the same light is projected through a given negative and the head is raised to obtain a larger print, the intensity of the light on the easel is diminished thus requiring a longer printing time. The diaphragm opening of the lens controls the amount of light passing through the lens and thus when the lens is closed down to a smaller aperture a longer printing time is required.

There are two other factors which can affect exposure, which apply to "Varigam" only. If the negative being printed is "normal," that is, one which will print best with a #5 filter, then it is practical to make the print on "Varigam" paper without any filter at all, for "Varigam" without a filter produces the same contrast as is obtained with the #5 filter. When a print is made without a filter the exposure time is reduced by about one-half, as the graph above shows.

It is better to form the habit of printing with the #5 filter rather than with no filter at all. Once the first print or the first test strip is made you may decide that a little more or a little less contrast is desirable, and so change to the #6 or #4 filter. If the #5 filter was used to begin with you already know the exposure, but if no filter was used an additional exposure test might be needed, because the paper requires about twice as much exposure with a filter as without one.

With a given set of conditions the exposure required for filters #1 through #7 is substantially the same. But if filter #8, #9 or #10 is used a slight increase in exposure is required.

Testing for Exposure

Let us assume that the negative is in place in the negative carrier, that you have adjusted the enlarger to produce the enlargement desired, placed the selected filter in position and focused the image

carefully. How much exposure will be needed to produce a good print?

The experienced printer can make a fairly accurate estimate simply because he has printed similar negatives many times before, but the beginner has no such basis for judgment. He will save time and money by making test strips to determine the proper exposure.

It is a good plan to form the habit of observing the negative image projected to the desired size upon the enlarging easel with the enlarger lens wide open. In time the brightness of the image, so seen, will provide the basis for an accurate estimate of exposure. Since the degree of enlargement is one of the factors which controls exposure it is important to adjust for this first. Obviously, the observation must always be made at the same aperture and since a wide open lens delivers the brightest image, it is most convenient for the purpose.

The Single Test Strip

First cut a piece of the paper you are going to use for the final print into small strips — a piece 2" x 5" is usually large enough for the purpose. Place an unexposed test strip on the easel in such a manner as to include the most important high-light and shadow areas of the picture. Make the estimated exposure, develop for *the recommended time of 2 minutes*, rinse in the stop bath briefly. One minute in the fixer is enough, since the test strip will be thrown away as soon as inspected.

Inspect the test strip in white light before proceeding. A print inspected under the darkroom illumination is apt to appear darker than it really is. The more time spent in making test strips and regular prints the more adept at judging the exposure time the operator will become. If the first test strip is too dark, it has been overexposed and either an adjustment in the length of exposure time or a further stopping down of the diaphragm to a smaller aperture will be necessary. Make another test and if after inspection in white light it is satisfactory proceed with the final print. Remember that if the size of the print is changed it will be necessary to make a new test strip and either decrease or increase the exposure accordingly.

Multiple Test Strip

Time can often be saved by making several test exposures on a single piece of paper. Take a piece of paper about 4" x 5" and place



42 Six step test strip to determine exposure. Reading from right to left the strips received exposures of 10, 20, 30, 40, 50 and 60 seconds at f/16. The proper exposure is seen to be about 40 seconds.

it on the easel under the red filter. Now, cover all but about a one inch section along the left side of the test strip with a piece of opaque cardboard or paper. Stop down the diaphragm of the enlarging lens to about f/11 or f/16 and make an exposure of say 10 seconds, deliberately selecting a time which will produce underexposure. Move the cardboard one inch to the right and make another exposure of 10 seconds. This exposure will affect *both* the first and second sections of the strip. Repeat this procedure until you have made four exposures. (A longer series of exposures may be made using a larger piece of paper and applying the same principal.) Now, the first section will have received 40 seconds exposure, the second 30 seconds, the third 20 seconds and the fourth 10 seconds. Since the entire piece of paper is developed at one time it is an easy matter to select the most appropriate timing after the paper has been fixed and inspected

in white light. Should one strip which received say 30 seconds exposure, be a little too dark and its neighbor at 20 seconds a little too light, it is easy to estimate an intermediate exposure that would be correct. Be sure to place the filter in place before running the test exposures so that the strip selected for exposure will also have the same contrast as the final print. The result of a six section test is shown in Figure 42.

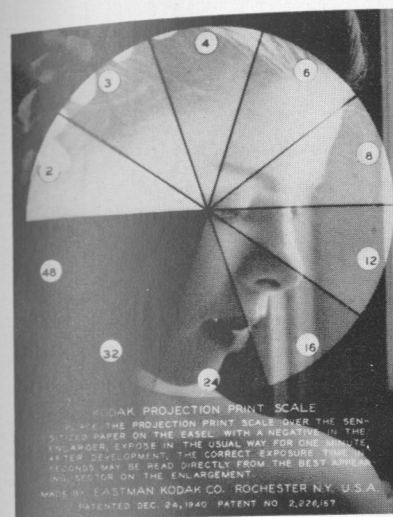
Kodak Projection Print Scale

There are several commercial pieces of equipment available for determining exposure on all printing papers, which may be used with "Varigam." One of these, the Kodak Projection Print Scale, is extremely simple to use and quite practical. It consists of a piece of film about 4" x 5" showing a circle divided into ten pie-shaped segments each of a different density. Each segment has an indication in seconds of a different printing time. Place the print scale over a piece of "Varigam" on the enlarger easel. With the negative in the enlarger and the "Varigam" filter in place, expose for one minute, develop and fix. The photographer can then read the exposure time in seconds directly from that sector of the test print which shows the desired density (Figures 43 and 44). Photometers, such as the Haynes Photometer, have been available, but since there can be a slight variance in paper speed from emulsion to emulsion there is no method more satisfactory than one which involves the making of a test print on the same emulsion as is to be used for the final print.

Desirable Exposure Times

As a general thing you should adjust the strength of the light in your enlarger so that a negative of average density will print in the time desired at a lens aperture of either $f/5.6$ or $f/8$. If you do this you can open the lens up for a dense negative (or a big enlargement) or close it down for a thin negative (or a small enlargement) and thus avoid the necessity for extremely short or extremely long exposures, neither of which is desirable. All well-designed enlargers will be so adjusted. But what is a "desirable" printing time?

Obviously, the professional who is producing a large number of prints will need to work for the minimum exposure commensurate with quality. The amateur, however, will be well advised to use ex-



43 Print exposed for 1 minute through Kodak Projection Print Scale. The proper exposure is seen to be 16 seconds.



44 Print from same negative exposed for 16 seconds.

posures of *at least* 10 seconds, and longer exposures if dodging or other manipulations are to be carried out. The longer exposures can be more accurately made and are easier to duplicate.

6. STRAIGHT PRINTING WITH NORMAL NEGATIVES

At long last we have cleared away most of the preliminaries and are about ready to proceed with actual print making. In this chapter we will examine each step in the enlarging process, and point out all of the things you must guard against to achieve quality prints.

Cleanliness

Absolute cleanliness of the darkroom as a whole, of the enlarger itself and of all trays and other utensils, is essential. In particular, chemicals in powder or crystalline form should be mixed into solutions outside of the darkroom, and any spilled solutions must be completely cleaned up, not just mopped over, or they will leave a fine deposit.

Clean the Enlarger

Care should be taken to be sure that the enlarger, both inside and out, is entirely free of dust, lint and dirt. Use the vacuum cleaner. The enlarger lens should be cleaned at frequent intervals, both front and back elements, by breathing on them and wiping with a soft linen handkerchief or lens tissue. A dirty enlarging lens is one of the commonest causes of inferior print quality.

The enlarger must be mounted on a firm support so that it remains rock steady, even during a prolonged exposure.

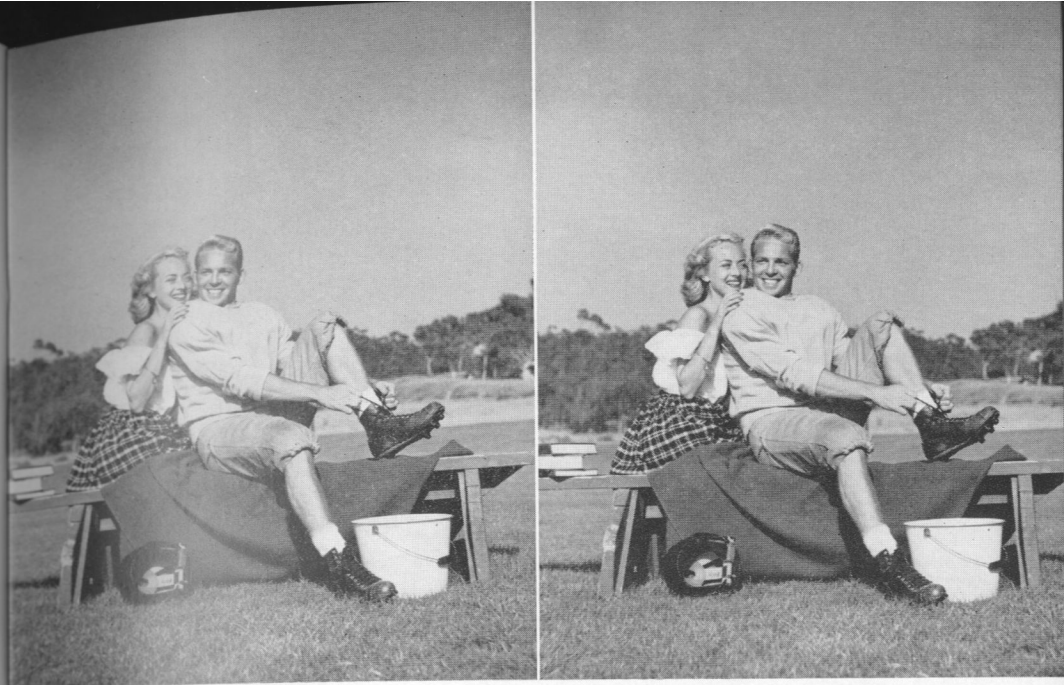
Safelight and Red Filter

Do not fail to carry out the test described on page 25 to make sure that your safelight is entirely safe. If it is only half-safe you can never achieve a clean bright highlight in any print because exposure from the safelight will cast a veil over the print.

While you are about it make the same test to be sure that the red filter on your enlarger is also safe.

Keeping Paper

Keep your paper supplies in a cool, dry place, away from heat, moisture, chemical fumes and radiation. Be certain that all paper is completely protected before turning on the white light in the darkroom. Light *can* go around corners, even creep inside of boxes if the covers do not fit tight. The original envelope or box including *all*



45 Exposed for 3 seconds without filter.

46 Exposed for 6 seconds with #5 filter.

layers of black paper provides the best protection.

With all equipment clean and in good order the first step in the enlarging process concerns the "reading" of the negative as has been explained in Chapter 4.

In this chapter we are concerned only with normal negatives, which by definition are those which will print best with the #5 filter, or may also be printed without a filter because "Varigam" produces the same contrast without a filter as it produces with the #5 filter. Figure 45 was exposed for 3 seconds without any filter, Figure 46 for 6 seconds with the #5 filter, and the results are identical.

With the filter selected, the next step is to brush the negative thoroughly on both sides with a camel hair brush to remove lint and dust. Always handle a negative by the edges only, to avoid fingerprints on its surface which would show in the print. If the negative carrier consists of two pieces of glass with the negative in between, the glass should be cleaned with a glass cleaner and wiped dry with a soft lintless cloth. Place the negative in the negative carrier emulsion (dull side) down.

2 1/4 x 2 1/4" negative and the type matter on a 4 x 5" negative.

For editorial purposes we wanted to obtain a very soft, high key rendition of the figure, without the umbrella, and with the line of type overprinted across it.

The problem involved was to superimpose the lettering from the one negative upon the toned down figure so that they would appear as one print.

First the smaller negative of the figure was placed in the enlarger with the normal 3" enlarging lens and matching condensers in place. A blank piece of white paper was placed on the enlarging easel and the negative was projected to the size desired in the final print. The enlarging lens was thrown slightly out of focus and a tracing of the figure was made upon the paper. A test strip was then run and since the figure was to be subdued a soft filter was used. The most satisfactory test showed an exposure of 9 seconds at f/16 with the #4 filter in place. This data was jotted down on the piece of paper and the negative removed from the enlarger.

Second, the large 4 x 5" negative of the copy was placed in the enlarger with the normal 5" enlarging lens and matching condensers. The negative was focused in the enlarger to the desired size, proportionate to the already traced pattern of the figure on the paper, and the easel was placed under the image so that the copy fell in the desired position in relation to the figure. Again a rough tracing of the lettering was made on the plain piece of paper. The highest possible contrast was desired so that no tone other than the extreme black of the copy would appear. A test strip was run with #10 filter, and an exposure of 10 seconds at f/16 was arrived at as giving the maximum contrast.

Now, with the 4 x 5" negative already in position, the unsensitized sheet with the tracing was removed from the easel and a sheet of "Varigam" substituted. An exposure was made according to our previous test and the "Varigam" was removed from the easel. The back of the paper was marked so as to indicate the top for proper replacement on the easel for the second exposure. The 4 x 5" negative was now replaced by the 2 1/4 x 2 1/4" negative, the 3" lens and condensers set in place and the tracing replaced on the easel. The size and focus was adjusted so the image corresponded to the previous tracing. The tracing was replaced by the already once exposed sheet

of "Varigam" and the second exposure was made. During the exposure the umbrella portion of the negative was dodged out so that the top blended off into the white surroundings (Fig. 78).

By means of double printing and the other manipulations a complete change in the meaning and character of the original pictures has been brought about.

Focal Length of Enlarging and Condenser Lenses

The reader will have noticed that in making the print just discussed we used a 3" lens and accompanying condenser lenses with the 2 1/4 x 2 1/4" negative and a 5" lens and accompanying condensers with the 4 x 5" negative. Why the change?

As a general rule the focal length of the enlarging lens should be approximately equal to the diagonal of the negative, for two reasons. First, because such a relationship assures that the lens will cover the negative from corner to corner and second, so that fairly large prints can be made without raising the enlarger head beyond a reasonable amount. The longer the focal length the higher the enlarger head must be raised for a given size print from a given size negative. If large blow-ups are to be made from a *portion* of a negative it is practical to deliberately use a shorter focal length than normal and thus reduce the projection distance. Just check to make sure the lens covers the *portion* of the negative to be printed.

For efficient use of the light, the focal length of the condensing lens must be such as to project an image of the light source within the projection lens. Consequently, if the focal length of the projection lens is changed, the focal length of the condensers must be similarly changed or a great reduction in light efficiency will result.

Printing-In Clouds

We have already learned that it sometimes becomes necessary, when printing from two negatives on the same sheet of paper, to use different contrasts as a means of tonal balance. Such a manipulation may be required because the negatives used are of different contrast or because they are of the same contrast and need differentiation.

Usually when clouds are to be added to a print which lacks interest because of a bald sky (Fig. 79) there is a difference in the contrast of the negatives. Since the pictures may have been shot under



79-80 Straight prints of negatives to be combined.

varying conditions and at different times there are seldom the same tonal characteristics apparent in both negatives. A billowy cloud effect was selected (Fig. 80) as the one to print in with the cypress trees in the foreground. A test strip showed that the picture of the clouds should be printed through a #6 filter for 15 seconds at $f/8$. Upon placing the second negative in the enlarger it was found that the proportionate size of the images did not require that the enlarging head be raised or lowered to achieve the desired placement of the two images in the composition. This, of course, makes it easier to proceed. Whenever it is necessary to raise or lower the enlarger head in order to adjust the size of the image when changing from one negative to the other, it is necessary to make a pencil outline of *each* image on a spare piece of paper. This outline serves as a guide for readjusting the enlarger, so the two images will go together as desired. In this particular example the negative of the tree was first placed in the enlarger and an exposure of 15 seconds at $f/8$ through a #8 filter was made. Always print the negative which requires the *higher contrast filter first*. The tree negative was then replaced by that of the clouds and without any necessity for removing the "Vari-gam" from the easel, the second exposure was made with the #6 filter for 15 seconds at $f/8$. Since there were some conflicting elements at the bottom of the cloud picture, this area, up to the horizon line, was held back in the second exposure so that it would not print.



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The combination print.

If, as in some cases, the horizon line is too irregular to hold back in this manner it may be necessary to cut a mask from a piece of opaque material and print each portion of the picture separately through its respective filter. There is no doubt, however, that the addition of clouds lends the necessary pictorial interest to the scene (Fig. 81).

Miscellaneous Considerations

In producing prints from one or more negatives by the multiple exposure techniques just described, attention must be paid to adjusting the depth of tone and the contrast of each image so that it will appear to recede or come forward in the picture space as desired.

It is not sufficient to simply produce a print identical to what would be made if the negatives were printed separately. If an image is to seem to be at a distance it should be slightly softened in printing. If it is to occupy the immediate foreground it should be somewhat more vigorous.

If one image is enlarged to a considerable degree and the other only slightly some allowance should be made for that, for enlargement to progressively greater sizes tends to reduce contrast slightly.

Figure 82 was made from two 4 x 5" negatives both of which would print best as *separate* pictures with a #5 filter. Let us follow the procedure and see what adjustments were made in combining them.

Since the foreground image was to be enlarged more than the background image, it was first necessary to make a tracing on a spare

piece of paper which would show the position and size of each image in the final print. This serves as our guide for readjusting the enlarger when changing from one negative to the other.

Test strips were run on both images in their respective sizes. These were carefully checked against each other under white light and an effort was made to achieve a depth of tone and a contrast which would cause the foreground image to come forward and the distant image to recede.

The foreground image was printed first through a #6 filter for 10 seconds at $f/8$ with that portion of the paper which was to receive the second exposure being carefully shielded. The "Varigam" paper was removed from the easel and marked on the back so the top could be identified. The second image was placed in its proper position by using the tracing as a guide. The "Varigam" was then replaced on the easel and a second exposure through the #3 filter was made for 7 seconds at $f/32$, this time carefully shielding the area of the first exposure from the second image. Notice that we changed from a #5 to a #6 filter in printing the foreground image and from a #5 to a #3 filter in printing the background image. By giving the foreground figure a little more contrast and allowing the background figure to go soft a greater illusion of depth has been obtained from negatives of the same quality.

Density Control With the Softest Filters

The worker will sometimes find that prints made with the #1 or #2 filter will not have quite as deep a maximum black as can be obtained without a filter or with any of the other filters of the 10-filter series. These filters produce a beautiful separation of highlights and middle tones, but increased exposure will not produce the maximum black.

This difficulty can be completely overcome by making a preliminary exposure for the shadow areas with one of the higher numbered filters and then completing the exposure with the #1 or #2 filter. Test strips should, of course, be made to determine the proper filters and the division of the exposure.

When the negative contains very dense highlights which would ordinarily have to be burned in, this technique will often produce fine



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Combination print in which the more distant image is printed softer to bring out a feeling of depth in the picture.

highlight detail without local printing.

Controlling Both Contrast and Exposure With Dyes

Now that we understand the nature of "Varigam" and how it works we can readily see that if we applied a dye, of the same color as the #10 filter, to a part of a negative and then printed it, the part so dyed would print with the same contrast as with a #10 filter. Other contrasts could be produced in the same way with dyes which matched any of the other filters.

Further, a light wash of a red or reddish dye would reduce the exposure in the area it covered because "Varigam" is not sensitive to red light. So, by a combination of these methods it is possible to achieve local control of both contrast and exposure.

Obviously, it will take practice to learn to apply the dyes properly. Even with experience the method requires considerable advance preparation.

Because of this it is not very practical for amateur use, but if a

large number of identical prints need to be made from a problem negative, it offers a solution.

The Du Pont Photographic Laboratory has found that the inexpensive "Tintex" household dyes, widely sold by drug, variety and department stores, are satisfactory for the purpose. Prepare the following solutions:

"Varigam" #1 Filter Dye Solution

Dissolve 1 package (designated "large") of Tintex #5 Brilliant Yellow in 1 quart (1 liter) of water at 120° F. (52° C.). Leave any undissolved residue in the bottle.

"Varigam" #5 Filter Dye Solution

Dissolve 1 package ("large") of Tintex #45 Old Rose in 1 quart (1 liter) of water at 120° F. (52° C.).

"Varigam" #10 Filter Dye Solution

Solution A—Dissolve 1 package ("large") of Tintex #21 Cocktail Blue in 1 quart (1 liter) of water at 120° F. (52° C.).

Solution B—Dissolve 1 package ("large") of Tintex #11 Fuchsia in 16 ounces (500 cc) of water at 120° F. (52° C.).

For use mix 3 parts of A and 1 part of B.

It is best to apply the dyes to a sheet of Du Pont "Adlux" film, the same size as the negative, which has been fixed in a 20% solution of plain hypo, (2 ounces of hypo in 10 ounces of water) washed for 10 minutes and thoroughly dried.

The yellow #1 dye is applied to areas in which the contrast is to be reduced. The magenta #10 dye to areas in which the contrast is to be increased. The orange #5 dye does not affect contrast but reduces the effective exposure in the areas in which it is applied.

To obtain intermediate contrasts take a small amount of the #5 dye and add varying amounts of the #1 or the #10 dye.

A more even application is obtained by repeated light applications followed by blotting with a piece of drying blotter. If too much dye is applied it may be reduced by local application of water, or removed entirely with a weak solution of ammonia.

In projection printing place the "Adlux" mask on top of the top glass in the negative carrier and use a third glass plate to hold the mask flat and in register. This separation provides ample blending of the colors, minimizes definite lines of demarcation, and eliminates the effect of the matting of the "Adlux." Thus sharp prints can be made without introducing added diffusion. For contact printing the mask occupies the same relative position but can be placed in contact with the back of the negative.

11. TONING "VARIGAM"

Before attempting to tone any print it is well to bear in mind several general facts that will relieve some of the troubles so often encountered in toning any photographic emulsion. Prints to be toned should not be left in the fixing bath any longer than the recommended time. The Du Pont 8-F fixing bath (see page 39) is recommended for prints which are to be toned. Thorough washing is an absolute must since any residual hypo remaining in the print will cause stains when the print is placed in the toner. Prints that are to be toned by a bleach and redevelopment method should be printed slightly darker than normally required for an untuned print.

"Varilour" Preferred

If it is known in advance that the print is to be toned it is advisable to make the print on "Varilour", because this emulsion tones more readily in a greater variety of toning formulas than any other variable contrast paper.

Toning "Varilour"

"Varilour" produces a warm black tone when processed in the recommended developer, Du Pont 55-D.

Properly processed prints will tone well in any of the packaged toning solutions generally available, including the selenium and hypo-alum type toners which are not recommended for "Varigam".

Most photographers who read this book will have a favorite toner with which they are reasonably familiar. In all probability they can continue to use that same toner on "Varilour" with equally good results. This does not mean that they will necessarily obtain *precisely* the same color on "Varilour" that was obtained with some other paper. The developing formula, the amount of exposure and the length of development, all have some bearing on the color of the toned print. Consequently, it may be necessary to make some slight adjustment in these factors in order to obtain the exact color desired. Adjustment of these factors is discussed in detail at the close of this chapter.

For those desiring to mix their own solutions for toning "Varilour" the following formula is recommended by Du Pont.

Du Pont 7-T Polysulfide Direct Toner

Stock Solution	Avoirdupois	Metric
Liver of Sulfur.....	6 ozs., 300 gr.	200 grams
Sodium Carbonate monohydrated*.....	1 oz., 300 gr.	50 grams
*If anhydrous, use.....	1 oz., 183 gr.	42.5 grams
Water to make.....	32 oz.	1 liter

For use, take 1 part of stock solution to 10 parts water.

Immerse well washed prints in diluted toner for 15-20 minutes at 68° F. (20° C.). Toning time may be shortened to 3-4 minutes by heating solution to 100° F. (38° C.).

If, after use, the solution turns cloudy, add 5 grams Sodium Carbonate monohydrated to each liter of working solution (77 grains per quart) to extend the working life.

After toning, rinse prints for 1-2 minutes in a 2% Sodium Bisulfite solution (20 grams of Sodium Bisulfite in 1 liter of water or 300 grains in 1 quart of water).

If the emulsion becomes soft during toning, immerse prints, after the Sodium Bisulfite treatment, in a hardening bath made by diluting Du Pont 2-FH Stock Hardener with ten parts of water.

Complete the operation by washing for 20-30 minutes in cool running water.

Du Pont 2-FH Acid Hardening Bath

	Avoirdupois	Metric
Water (125° F. or 52° C.).....	16 fl. ozs.	500 cc.
Sodium Sulfite, Anhydrous.....	2 ozs.	60 grams
*Acetic Acid, 28%.....	8 fl. ozs.	190 cc.
Potassium Alum.....	2 ozs.	60 grams
Add cold water to make.....	32 fl. ozs.	1 liter

*To make 28% Acetic Acid dilute 3 parts glacial acetic acid with 8 parts of water.

The formulas which follow are recommended for the toning of "Varigam" but all of them will work equally well with "Varilour".

Toning "Varigam"

While the Du Pont Company has no prepared toner for "Varigam" they have prepared several formulas which produce very satisfactory results. The paper will not tone satisfactorily in hypo-alum and selenium type toners, but will react favorably in most bleach and redeveloper toners. It is no more difficult to tone "Varigam" than conventional papers provided instructions are followed and care is exercised. Many of the prepared commercial formulas will react favorably but only some experimentation will enable the user to select the tone most suitable for his needs.

Du Pont 4a-T Toner

The Du Pont 4a-T formula is a redevelopment sepia toner which will produce a warm brown sepia tone.

The formula is as follows:

Bleaching Solution:

	Avoirdupois	Metric
Water, not over 80° F. (27° C.).....	24 ounces	750.0 cc.
Potassium Ferricyanide	365 grains	25.0 grams
Potassium Bromide	400 grains	27.4 grams
Ammonium Hydroxide (28%).....	1/2 fl. dram	2.0 cc.
Add cold water to make.....	32 ounces	1.0 liter

Use undiluted.

Redeveloper Solution:

Sodium Sulfide (not sulfite).....	1 oz. plus	
	292 grains	50.0 grams
Water	32 ounces	1.0 liter

Dilute 1 part stock solution to 8 parts water for use.

Bleach prints, which have been thoroughly fixed and washed, in bleaching solution until image is only faintly visible—30 seconds to 1 minute. Wash thoroughly until no trace of yellow stain remains. Redevelop in redeveloping solution, diluted as directed, until the desired tone is obtained. Wash prints thoroughly and dry as usual.

Prints on rough textured paper should be dried before bleaching.

Du Pont 6-T Thiocarbamide Toner

For a greater range of tones on "Varigam" Du Pont recommends their 6-T formula. By variation of the combinations of bleaches and redevelopers, it is possible to obtain over 50 different tones and colors on "Varigam."

The following formulas have been prepared especially for the toning of "Varigam" paper. The toning procedure is accomplished in two or three stages:

B.—Bleaching. T.—Toning. G.—Gold Tone-modifying.

"Varigam" Toning Bleach 6B-1

	<i>Avoirdupois</i>	<i>Metric</i>
Water	24 ounces	750.0 cc.
Potassium Ferricyanide	320 grains	22.0 grams
Potassium Bromide	365 grains	25.0 grams
Add water to make.....	32 ounces	1.0 liter

"Varigam" Toning Bleach 6B-2

Water	24 ounces	750.0 cc.
Potassium Ferricyanide	320 grains	22.0 grams
Potassium Iodide	146 grains	10.0 grams
Add water to make.....	32 ounces	1.0 liter

"Varigam" Toning Bleach 6B-3

Water	24 ounces	750.0 cc.
Potassium Ferricyanide	320 grains	22.0 grams
Sodium Chloride	1 oz. 75 gr.	35.0 grams
Nitric Acid	1/2 ounce	15.0 cc.
Add water to make.....	32 ounces	1.0 liter

Prints should be developed for one and one-half minutes at 68° F. (20° C.) in Du Pont 55-D and fixed for at least 5 minutes in Du Pont 8-F.

Acid hardening fixing baths are not recommended because slow and incomplete bleaching may occur.

Prints are then thoroughly washed, after which they are bleached in one of the above bleaching baths for twice the time necessary to completely convert the black image. Then wash again through three changes of water until the image is free of the yellow color of the bleach.

The bleached print is then placed in one of the following toning baths and left until toning is complete.

"Varigam" Toner 6T-1

	<i>Avoirdupois</i>	<i>Metric</i>
Water	24 ounces	750.0 cc.
Thiocarbamide (Thiourea)	44 grains	3.0 grams
Sodium Hydroxide	88 grains	6.0 grams
Add water to make.....	32 ounces	1.0 liter

"Varigam" Toner 6T-2

Water	24 ounces	750.0 cc.
Thiocarbamide (Thiourea)	44 grains	3.0 grams
Sodium Carbonate	1 1/2 ounces	45.0 grams
Add water to make.....	32 ounces	1.0 liter

"Varigam" Toner 6T-3

Water	24 ounces	750.0 cc.
Thiocarbamide (Thiourea)	44 grains	3.0 grams
Potassium Carbonate	1 oz. 262 gr.	48.0 grams
Add water to make.....	32 ounces	1.0 liter

Various combinations of bleach and toner will give different tones as shown by the following table:

Bleach in	Tone in	Type of Tone Resulting
6B-3.....	6T-1.....	Deep brown. Slight purplish tint.
6B-1.....	6T-1.....	Deep brown tint.
6B-2.....	6T-3.....	Increasing warmth with a golden
6B-1.....	6T-3.....	tinge till a bright sunlit type of
6B-3.....	6T-3.....	sepia is produced with the combination of 6B-3 and 6T-3.

6T-2 can be used instead of 6T-3 but it gives a little colder color and is given as an alternative when potassium carbonate is not available.

Gold Tone Modifier for "Varigam" prints

	<i>Avoirdupois</i>	<i>Metric</i>
Gold Chloride	14 grains	1.0 gram
Potassium Thiocyanate	90 grains	6.0 grams
Add water to make.....	32 ounces	1.0 liter

If this bath is used directly on a black and white "Varigam" print, the resulting tone is an interesting blue-black.

The gold tone modifier may also be used on prints which have been toned by any of the preceding methods. The toned print is first immersed in a 3% sodium chloride solution:

	<i>Avoirdupois</i>	<i>Metric</i>
Water	24 ounces	750.0 cc.
Sodium Chloride	1 ounce	30.0 grams
Add water to make.....	32 ounces	1.0 liter

After treatment in the sodium chloride bath the prints are rinsed briefly and placed in the gold tone modifier. In general the effect of this bath is to replace the golden tint by a reddish one. Toning may be continued from 2 to 16 minutes, the color becoming more purple as the toning proceeds. A short wash should follow before drying.

If a slight yellow stain appears on the gold toned print, it may be cleared with a second treatment in any standard fixing bath such as the 8-F previously recommended. Thorough washing should follow.

The following table indicates the effect obtained by gold modification after toning in the various Bleacher-Toner combinations.

Bleach in	Tone in	Tone resulting after Gold Modification
6B-1.....	6T-1.....	From purplish brown to rich purple colors.
6B-2.....	6T-1.....	Produces a more crimson-like tone.
6B-1 *.....	6T-3.....	A rich reddish brown.
6B-3 *.....	6T-3.....	A remarkably brilliant light reddish brown color, darkening as toning progresses.

*The 6T-3 toners when gold modified produce less purple colors than the 6T-1 toners.

All gold tone modified prints change color somewhat on drying and this change cannot be avoided. The color descriptions given above apply to the dried prints.

Use of Ansco Direct Sepia Toner With "Varigam"

While the Du Pont formulas offer a method of securing very excellent results for toning "Varigam," many darkroom workers lack facilities or equipment to mix chemicals and prefer a simpler and more direct method of toning. One of the simplest and readily available toners that will work efficiently with "Varigam" is the Ansco Direct Sepia Toner. The primary objection to this toner is its odor, but outside of that it is one of the most desirable of prepared toners. It is available in liquid form and need only be diluted with water for use. (*This toner is not recommended for "Varaloid".*)

After the print has been fixed and thoroughly washed it is immersed in a dilute solution of Ansco Direct Sepia mixed 1 part toner to 50 parts warm water. Variations of proportion will vary the tone from a warm split tone with more water, to a yellow brown with less water. The prints should be agitated in the working solution at 105° F. (40° C.) for a period of from 3 to 10 minutes. Since the entire procedure is carried out in normal room light the action of the toner may be observed and the print pulled from the solution whenever a satisfactory tone has been reached. The print must then again be washed thoroughly and dried. Experience and some experimentation will establish the exact proportion to use to get the desired effect.

Kodak Sepia Toner With "Varigam"

Another readily available toner of the bleach and redevelopment type is the Kodak Sepia Toner. In prepared powder form it is only necessary to add water to the two packet powders according to instructions to have working solutions of bleach and redeveloper. Each packet will produce a working solution of 32 ounces and if stored in full tightly stoppered bottles has very good keeping qualities.

As with all other toners the print must be fixed and thoroughly washed before any attempt at toning can be made. Easier toning can be achieved if the print is fixed in a non-acid-hardening fixing bath such as the Du Pont 8-F previously recommended. The print to be toned should be slightly darker than normal.

First the wet print is immersed in the bleach for about 1 minute and agitated until the black image has disappeared. It should then be washed for about 1 minute in running water. The bleached and washed print is then placed in the toner solution and agitated until there is no further change in tone. The toned print should then be washed in running water with thorough agitation for at least ten minutes before it is allowed to dry.

Various tones may be achieved by varying the length of time the print is first allowed to remain in the bleach. If all of the black is not allowed to disappear a very pleasant split tone (one in which there is an inherent warmth but the deepest black in the print remains intact) will result. Here again only experience and experimentation can help determine just exactly the time necessary to produce a certain desired tone.

Blue Toning With "Varigam"

While we usually think of toning in terms of "sepia" certain scenes such as night shots, water scenes and snow scenes are often enhanced with a blue tone. Two formulas are available for this process, the first of which, Iron Blue Toner is the simplest.

Iron Blue Toner

	Avoirdupois	Metric
Water (125° F. or 52° C.).....	16 ounces	500.0 cc.
Ferric Ammonium Citrate.....	1/4 ounce	8.0 grams
Potassium Ferricyanide	1/4 ounce	8.0 grams
Acetic Acid, 28%.....	9 ounces	265.0 cc.
Add cold water to make.....	32 ounces	1.0 liter

The solution should be prepared with distilled water. Do not use chipped or cracked enameled trays. Hard rubber or stainless steel trays are recommended.

Prints to be toned should have been fixed in a plain non-hardening fixing bath, such as formula 8-F.

After toning, the prints will have a greenish cast which washes out to a clear blue in running water. Care must be exercised in washing the blue toned prints, because the blue tone is soluble in alkaline water. To prevent fading of the brilliant blue during washing, the wash water should be slightly acidified with acetic acid at regular intervals during the washing period. Washing time will average about 10 minutes before excessive loss of the blue tone is noted. Prints to be toned should be slightly lighter than is desired in the finished print because the toner has a tendency to intensify.

Ilford Gold-Thiocarbamide Toner:

<i>Avoirdupois</i>	
A. Thiocarbamide	2.25 grains
Water to make	32 ounces
B. Citric Acid	2.25 grains
Water to make	32 ounces
C. Gold Chloride	88 grains
Water to make	32 ounces
<i>Metric</i>	
14 grams	1.0 liter
14 grams	1.0 liter
6 grams	1.0 liter
1.0 liter	1.0 liter

The three portions of this formula must be mixed separately. For use, one part each of A, B, and C and 10 parts of water are used. Prints should be toned up to 15 minutes or as necessary and washed thoroughly after toning. For best toning with this formula prints should have been developed in a warm tone developer. Following are two procedures favored by R. V. Kendall, an experienced amateur who does much toning on "Varigam." Develop the print for *not less than six minutes* in:

Edwal 106

<i>Avoirdupois</i>	
Water	24 ounces
Sodium Sulphite	1/4 ounce 40 grains
Sodium Carbonate, monohydrated	1/2 ounce 33 grains
Glycin	49 grains
Hydroquinone	17 grains
Potassium Bromide	7 grains
Water to make	32 ounces
<i>Metric</i>	
750 cc.	10.3 grams
17.2 grams	17.2 grams
3.4 grams	1.2 gram
1.2 gram	.48 gram
1 liter	1 liter

Use at full strength.
Dissolve chemicals in the order given.

This formula produces a pleasing warm black. Prints so developed tone to an attractive blue color in the Gold-Thiocarbamide toner, page 92, and they may also be toned in Selenium type toners, although such toners are not generally recommended for "Varigam." An alternate procedure is to develop the print *up to 3 minutes* in Du Pont 55-D. Bleach in Du Pont 6B-1 (which does not *completely* bleach out) and then tone in a mixture of equal parts of 55-D (*working solution*) and Du Pont 6T-1. This reduces the yellowness of the brown tone. Of course, the Du Pont 8-F fixing solution should be used on all prints which are to be toned.

While "Varigam" has often been considered more difficult to tone than conventional papers, this is not so provided reasonable care is taken and all directions are carefully carried out. Remember that some control in toning is exercised in the selection of the surface, paper developer and exposure. Somewhat cooler tones will result if the cold tone developers such as 53-D are used for the original development. The exposure time and development time are also prime factors. We have already seen that extended development or the reverse within the 1 1/2 to 2 1/2 minute limits recommended for the paper, affect the tone as well as the contrast of the paper. The longer exposure and shorter developing time will provide warmer color than the shorter exposure and extended development procedure. After some experience has been gained in the selection of a developer and toner combination, the effect desired can be more easily duplicated. With proper manipulation a great many different tones and colors can be obtained and very pleasing effects achieved.

Toning "Varaloid"

The toning characteristics of "Varaloid" are very similar to those of "Varigam". Consequently if you wish to tone "Varaloid" simply follow the instructions given above for the toning of "Varigam".

The solution should be prepared with distilled water. Do not use chipped or cracked enameled trays. Hard rubber or stainless steel trays are recommended.

Prints to be toned should have been fixed in a plain non-hardening fixing bath, such as formula 8-F.

After toning, the prints will have a greenish cast which washes out to a clear blue in running water. Care must be exercised in washing the blue toned prints, because the blue tone is soluble in alkaline water. To prevent fading of the brilliant blue during washing, the wash water should be slightly acidified with acetic acid at regular intervals during the washing period. Washing time will average about 10 minutes before excessive loss of the blue tone is noted.

Prints to be toned should be slightly lighter than is desired in the finished print because the toner has a tendency to intensify.

Ilford Gold-Thiocarbamide Toner:

	<i>Avoirdupois</i>	<i>Metric</i>
A. Thiocarbamide	225 grains	14 grams
Water to make.....	32 ounces	1.0 liter
B. Citric Acid	225 grains	14 grams
Water to make.....	32 ounces	1.0 liter
C. Gold Chloride	88 grains	6 grams
Water to make.....	32 ounces	1.0 liter

The three portions of this formula must be mixed separately. For use, one part each of A, B, and C and 10 parts of water are used. Prints should be toned up to 15 minutes or as necessary and washed thoroughly after toning. For best toning with this formula prints should have been developed in a warm tone developer.

Following are two procedures favored by R. V. Kendall, an experienced amateur who does much toning on "Varigam." Develop the print for *not less than six minutes* in:

Edwal 106

	<i>Avoirdupois</i>	<i>Metric</i>
Water	24 ounces	750 cc.
Sodium Sulphite	¼ ounce 40 grains	10.3 grams
Sodium Carbonate, monohydrated.....	½ ounce 33 grains	17.2 grams
Glycin	49 grains	3.4 grams
Hydroquinone	17 grains	1.2 gram
Potassium Bromide	7 grains	.48 gram
Water to make	32 ounces	1 liter
Dissolve chemicals in the order given.		
Use at full strength.		

This formula produces a pleasing warm black. Prints so developed tone to an attractive blue color in the Gold-Thiocarbamide toner, page 92, and they may also be toned in Selenium type toners, although such toners are not generally recommended for "Varigam."

An alternate procedure is to develop the print *up to 3 minutes* in Du Pont 55-D. Bleach in Du Pont 6B-1 (which does not *completely* bleach out) and then tone in a mixture of equal parts of 55-D (*working solution*) and Du Pont 6T-1. This reduces the yellowness of the brown tone. Of course, the Du Pont 8-F fixing solution should be used on all prints which are to be toned.

While "Varigam" has often been considered more difficult to tone than conventional papers, this is not so provided reasonable care is taken and all directions are carefully carried out. Remember that some control in toning is exercised in the selection of the surface, paper developer and exposure. Somewhat cooler tones will result if the cold tone developers such as 53-D are used for the original development. The exposure time and development time are also prime factors. We have already seen that extended development or the reverse within the 1½ to 2½ minute limits recommended for the paper, affect the tone as well as the contrast of the paper. The longer exposure and shorter developing time will provide warmer color than the shorter exposure and extended development procedure. After some experience has been gained in the selection of a developer and toner combination, the effect desired can be more easily duplicated. With proper manipulation a great many different tones and colors can be obtained and very pleasing effects achieved.

Toning "Varaloid"

The toning characteristics of "Varaloid" are very similar to those of "Varigam". Consequently if you wish to tone "Varaloid" simply follow the instructions given above for the toning of "Varigam".

12. Physical Characteristics of Available Variable Contrast Papers

In 1954 Du Pont licensed Ansco, Grant and Haloid to manufacture variable contrast photographic papers. The Grant product is sold only to the government and Ansco, so far, is only making a special product for use in high power rollhead printers.

The Haloid Company does not sell through photographic dealers, only direct to the consumer, but they are now offering three papers, regular "Varaloid", High Speed "Varaloid" and "Fast Varaloid Proof".

Variable contrast papers are not limited in their scope by any lack of interesting physical characteristics and with the advent of the new surfaces supplied by the addition of "Varilour" and "Varaloid" to the already popular surfaces of "Varigam", there is a surface, tint or weight, suitable for almost any type of work. While all printing papers consist of an emulsion coated upon a supporting surface, the surface may be finished in a variety of textures, weights and tints, as explained in Chapter 1.

Available "Varigam" surfaces and weights are as follows:

<i>Surface Designation</i>	<i>Description</i>	<i>Surface Designation</i>	<i>Description</i>
A*	White Semi-Matte, Single Weight	DS	Velvet Grain Natural White High Lustre, D.W.
AL*	White Semi-Matte, Document Weight	I	White Rough Matte, Medium Weight
B*	White Semi-Matte, Double Weight	R**	White Glossy, Single Weight
BT*	White Semi-Gloss, Double Weight	T**	White Glossy, Double Weight
DL**	Velvet Grain Natural White Lustre, D.W.	Y***	Cream White Silk, Double Weight

* Also available in High Speed "Varigam".

** Also available in High Speed "Varigam" and "Varilour".

*** Available in Regular "Varigam" and "Varilour".

A and AL are best for documentary copies. AL may be folded for enclosure in mail, etc.

B and I are a good choice if retouching with pencil or etching knife is to be used.

R and T are the glossy surfaces and the smooth surface of BT is also suitable for reproduction purposes when glossy is not specified.

DL and DS are ideal for portraits or landscape scenes. The fine pebbly surface seems to add richness to the print. DL is also recommended if the print is to be oil colored.

The rough texture of I is fine for portraits of older people, or for any picture where detail is to be suppressed.

High key prints appear to best advantage on B or I, while the silk surface of Y is popular for wedding photographs.

Envelope sizes of Du Pont papers are available in five packages only, 4"x5", 5"x7", and 8"x10" in 25's and the 11"x14" and 16"x20" in 10's. Other sizes are available in boxes of 100, 250 and 500 sheets up to and including 8"x10". Other sizes on up to 20"x24" are available in boxes of 50 and 250. For other available sizes and rolls see your dealer.

Available "Varaloid" surfaces and weights are as follows:

<i>Surface Designation</i>	<i>Description</i>	<i>Surface Designation</i>	<i>Description</i>
E	Smooth Matte, White, Single Weight	FF	Glossy, White, Double Weight
F	Glossy, White, Single Weight	GG	Semi-Rough, White Eggshell Surface, Double Weight
EE	Smooth Matte, White, Double Weight	Silk	Silk Finish, Double Weight, White

All of these surfaces are available in Regular "Varaloid" and High Speed "Varaloid" except silk which is stocked in High Speed only.

"Fast Varaloid Proof" is a white rough matte suitable for pencil and the use of the etching knife.

"Varaloid" is printed with the Du Pont Plastic Filters; the Du Pont S-55X safelight is recommended and in all other respects it is handled exactly the same as "Varigam". A contrast comparison with "Varigam" and two graded papers is given in the table on page 45 and a similar speed comparison is given in the graph on page 48. "Varaloid" will not tone readily in any of the prepared single solution toners. It is best toned by the bleach and redevelopment method. Its toning characteristics are similar to those of "Varigam".

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